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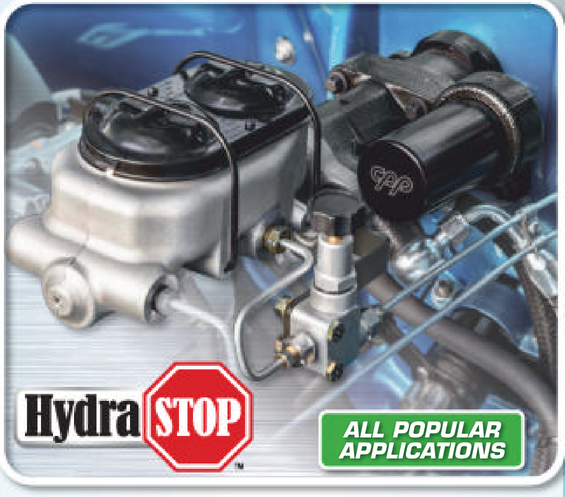
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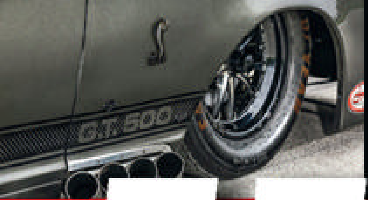

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Contents

HOTROD.COM EVERYDAY

06
Starting Line
with John McGann

08
Where It All Began:
Organized Drag Racing

10
HOT ROD
20, 40, and 60 Years Ago

12
Dennis Varni's
Three-Window '34 Ford

22
Guided Missle:
'67 Pro Mod Mustang

28
'59 Studebaker Scotsman:
This is No Farm Truck

34
LS Cylinder Heads:
Shootout and Cam Test

44
875 Hp Chevy Big-Block
Sledgehammer

52
Are Chevy's OBS Pickups
The Next Big Thing?

60
What is a
Throwout Bearing?

62
Quick Tech
With Marlan Davis

64
Project Update:
Flock That Dash

66
On Scene:
"Big Daddy" Roth
Mysterion

70
Reader's Tech Q&A

82
In the Words of Freiburger...

08

22

28

ON THE COVER:
Below: Dennis Varni's '34 Coupe
looks as good from every angle,
even when zoomed into
the smallest details.

Photo by **Michael Christensen**

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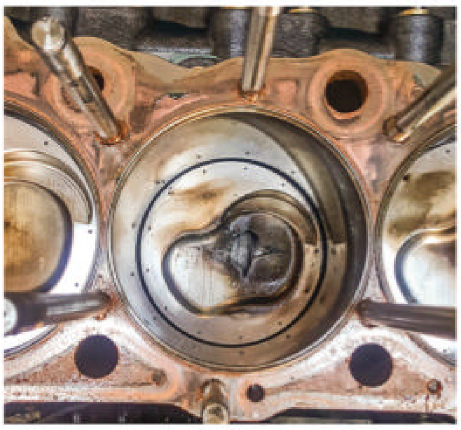

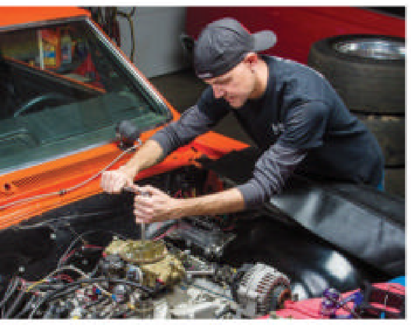

BE TENACIOUS

Photos by John Baechtal

By John McGann

Editor-in-Chief
@john.mcgann

The 2020 running of Bonneville Speed Week occurred last week, as I write this, and unfortunately, none of us were able to be there. These are unprecedented times, and not just for us in the media, but for all of us as a nation, if not the globe. Companies world-wide are tightening their belts, implementing hiring freezes, and cutting costs to survive an economic downturn, and ours was no exception. Without the financial means to travel to Bonneville, we relied on friends, racers, and social media to see what was happening there.

It's old news by now, but the Speed Demon streamliner posted the fastest flying mile and fastest top speed of the meet, earning the Hot Rod Magazine Trophy for the former, and setting a record for piston-powered, wheel-driven machines for the latter. What's not widely known is the struggle the team overcame to achieve them. Throughout the course of the week, they overcame a number of obstacles, ranging from leaking wastegates and shredded tires, to shredded ring-gear teeth in their differential, and ultimately, an oil fire and a melted piston. The team met each of these setbacks head on and persevered. They figured out the tuning issues, replaced the diff, and rebuilt the big-block Chevy in the pits using sandpaper, a brush hone, and a spare piston someone had the foresight to bring, all in 100-degree heat on a bed of salt.

It's easy to look at Speed Demon's operation and assume that money makes this all possible, but that would be too simplistic. Money helps, sure, but as Speed Demon crew chief Steve Watt told me on the phone, "Money doesn't buy records. It was the people involved who made it happen." He's right, and that's the crux of my line of thinking. I'm no sports fan, but I'm aware of many occasions where an NBA or NFL team owner packed the bench with multimillion-dollar superstars, thinking they'd have a lock on a Super Bowl win or an NBA title, only to achieve moderate success throughout the season, then be eliminated early in the playoffs. You may as well flush all that money down the toilet if the team doesn't work together successfully for a common cause.

In our conversation, Steve said he personally picked everyone on the crew, who received only a modest stipend for their time and effort and having to spend more than a week away from home. There's no financial incentive for anyone to be there other than to unite around the common cause of breaking the records each one of them believed the car could achieve. That's the kind of grit and determination I find inspiring in my daily life. I'm fortunate enough to be employed and in good health, but I personally know many people who are struggling terribly right now, fighting illness, unemployment, depression, and demons more serious than that. Being stuck as home, as many of us in metropolitan areas are, only compounds the problems.

These are the times I take inspiration from those who persevere and overcome the impediments that life inevitably puts in front of all of us, and hopefully I can use this modest platform to pass this inspiration on. Average folks can accomplish extraordinary things every day, and most of them go unrecognized. I'm sure Speed Demon wasn't the only team at Bonneville to succeed in spite of the challenges they faced, they just did it on a grander scale. But as a metaphor for life and the challenges we are all facing, I can think of no better example of people helping people and succeeding because of it. Congratulations to the Speed Demon crew.

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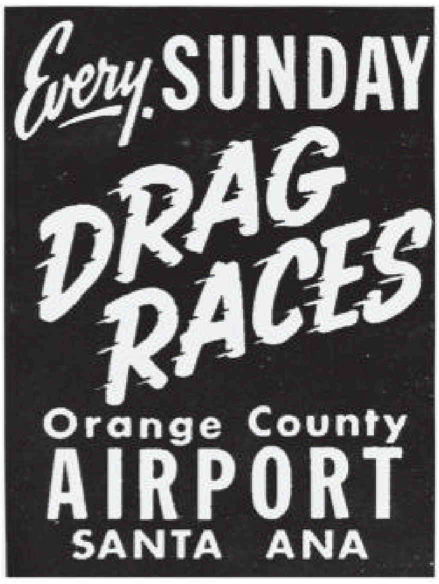
THE DAY ORGANIZED DRAG RACING WAS BORN

Organized drag racing celebrates its 70th birthday on July 2, 2020. On that day in 1950 the first "official" drag race took place at an out-of-commission Army airbase in Santa Ana, California. Soon that airbase was established as Santa Ana Drags, the world's first commercial dragstrip. When it closed nine years later, drag racing had become a nationwide sport with established rules and classes, national championships, and a major sanctioning body. Today, drag racing has evolved into a huge worldwide motorsport—and it also still exists at a smaller grassroots level not much different from what those guys in Santa Ana were doing 70 years ago.

When Did Drag Racing Really Start?

To say when drag racing began involves a lot of speculation about an activity that, in all likelihood, has been around since the creation of the second automobile. In the April 1950 issue of HOT ROD magazine, editor Wally Parks (one year before establishing the NHRA) wrote an article describing "controlled drag races" as an alternative to the type of racing that hot rodders had been doing on the dry lakes of Southern California since the '30s. Parks' description might seem foreign to today's drag racing fans, such as his explanation that the "number of entrants in each heat race depends on the width of the course."

I figured that the best way to find out some facts about the birth of drag racing was to talk to people who were actually there. About 12 years ago, I got in touch with Leslie Long, one of Southern California's early hot rodders. Leslie was on a personal mission to chronicle the history of drag racing at Santa Ana, collecting race results and photos from the strip's short run from 1950 to 1959. He said if I met him at his favorite diner in Santa Ana and bought him a cup of coffee, he'd tell me all about it.



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We ended up having several meetings. Our conversation at the first one was the basis for a May 2009 *Rod & Custom* magazine article called "The Guys Who Invented Hot Rods," about dry lakes racing before World War II. At later meetings, Leslie talked about drag racing at Santa Ana, sharing stories as well as the photos you're seeing here. These pictures, and the following information, originally appeared in the November 2009 issue of *R&C*.

Was Santa Ana really the first official drag race? In the spring of 1949, a year before Parks wrote that article for HOT ROD, rodders had gathered in Goleta, California, for a match race that some called the first official drag race. Parks' story refers to another location in Santa Ana where they were running two abreast, with one flagman at the starting line and another at the finish line a quarter-mile away. Since that article predates the July 2nd races at the Santa Ana airport, Wally might be referring to a different military airfield called Mile Square.

Images courtesy Leslie Long Archives

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77

According to Leslie, that location was a practice air strip where pilots were trained to land on aircraft carriers—and where hot rodders raced until armed Marines ordered them out.

Soon after, the Southern California Timing Association (SCTA), which had organized racing on the dry lakes, held a drag race at a nearby blimp base. Chuck Potvin (the racer and speed equipment manufacturer) tried, unsuccessfully, to convince the SCTA to continue with drag racing. "Nobody's interested in drag racing," they told him.

In 1950, CJ Hart, Creighton Hunter, and Frank Stillwell met with Santa Ana city officials to get permission to use that Santa Ana airfield for organized drag racing. On July 2, the first races were held there.

Leslie claimed that the first Santa Ana drags actually took place a month earlier. "CJ Hart ran two races that nobody knows about," he told me. "People have told me they didn't happen. Creighton Hunter told me I was crazy. But I was there. Word got out among the racers that they were taking place—they were only for the racers."

Those two June races, like the races in Goleta, at Mile Square, and other locations (including the streets) were grassroots activities. What was different about July 2 in Santa Ana was that the races were scheduled, organized, and official. And they were publicized.

By the mid-'50s, Hunter and Stillwell were no longer involved at Santa Ana, but Hart continued until the last race on June 21, 1959. By that time, drag racing had spread across the United States. Today, at age 70, drag racing is bigger, quicker, faster, more expensive, more commercial, and more popular than anybody could have imagined. Computer-equipped Top Fuel dragsters running at multi-million-dollar arenas are clocking mind-blowing elapsed times in the mid-3-second range at top speeds way beyond 300 miles per hour. And it all started with a bunch of hot rodders trying to beat each other to the finish line at an out-of-commission airfield in Santa Ana. **Tim Bernsau**

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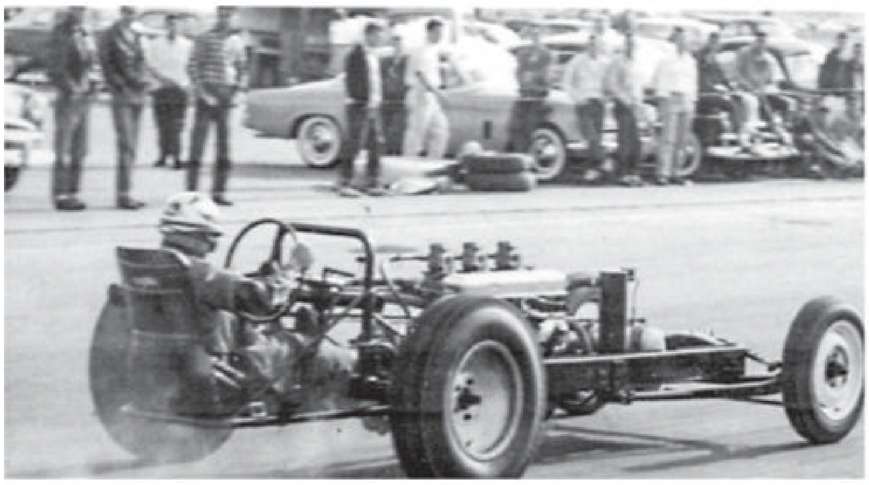

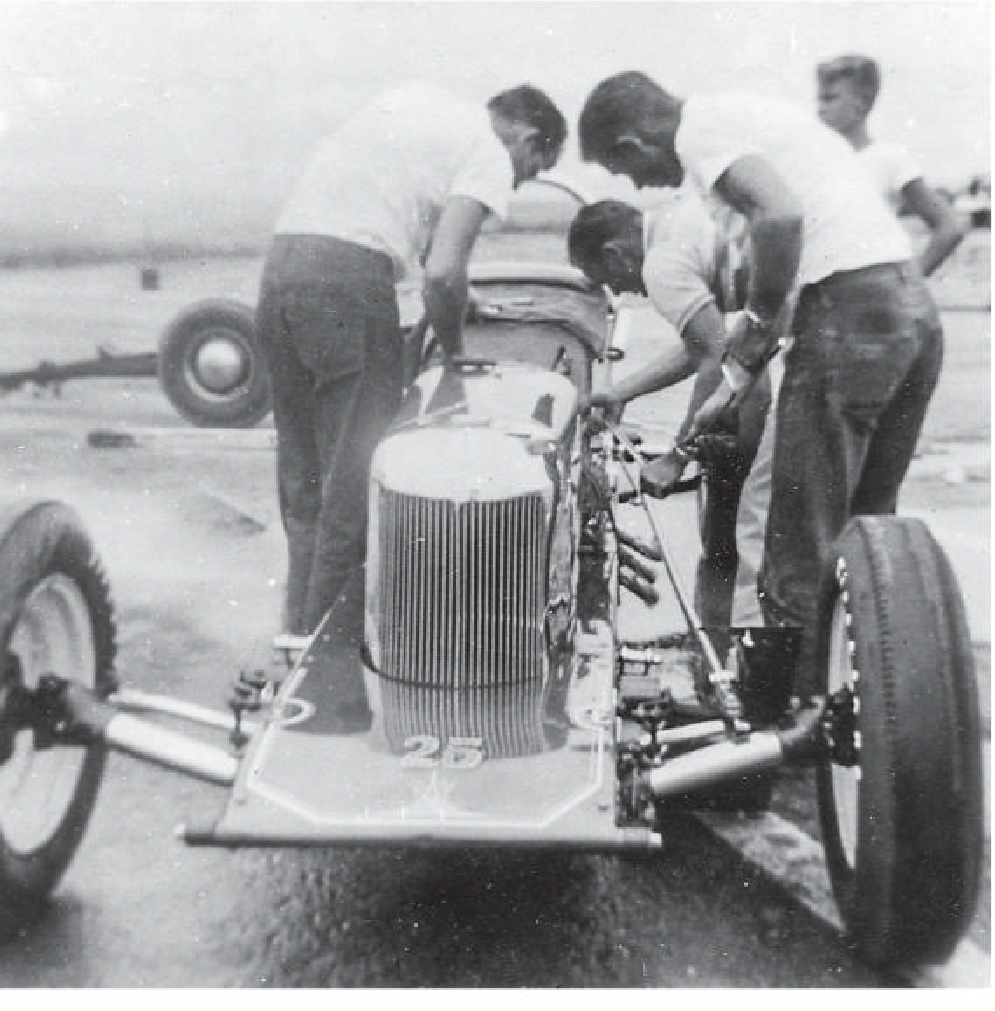

RICES
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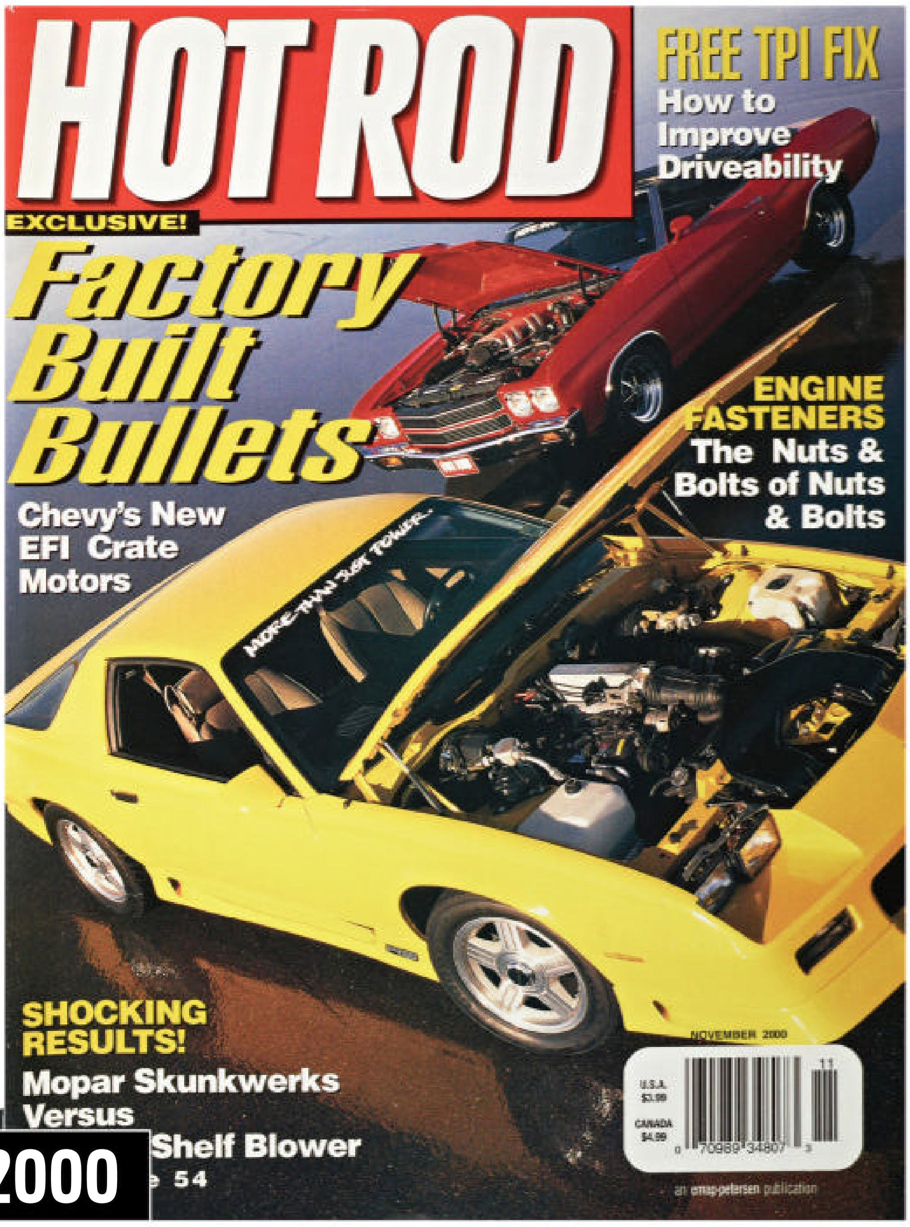
The HOT ROD Archives

20 Years Ago

November 2000: 164 pages, $3.99

Engine tech dominated this issue, starting with a piece on GM's then new Ram Jet 350 and 502 crate engines, which were noteworthy at the time because they were sold complete with an ECM and wiring harness—customers just needed to provide the car and make a few wiring connections. Incidentally, both engines are still available from Chevrolet Performance today, though with some slight updates to the components. Steve Magnante followed that up with a Slant Six Chrysler build, then bolted on a bunch of parts to a 5.9L 1989 Dakota pickup. Gray Baskerville covered the LA Roadster's Ragtop Reunion car show, and Jeff Koch did a feature on a cool '68 Valiant that looked like granny's grocery-getter but ran 11s.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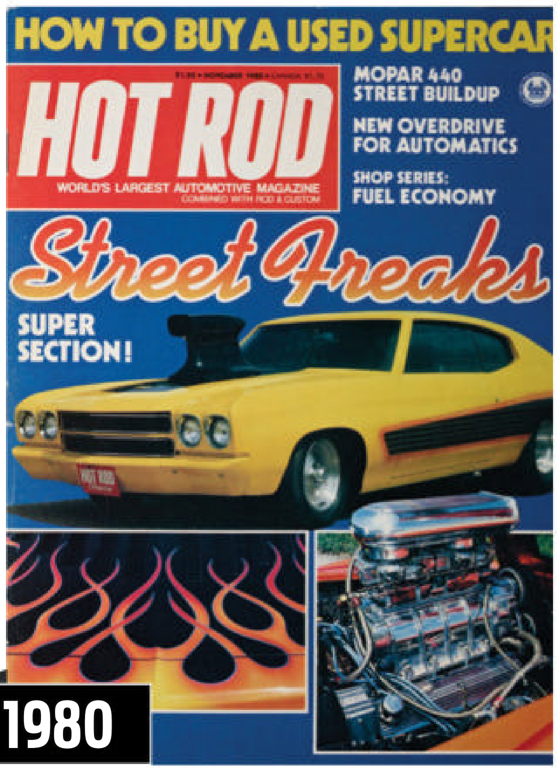
2000

40 Years Ago

November 1980: 112 pages, $1.50

If graphics and wild paint are your thing, you would have loved this Street Freaks themed issue. Inside were features on a '48 Anglia, a '40 Willys, a '68 Corvette with a tunnel ram atop its 327 small-block, the '70 Chevelle wearing a panel paint job and a Pro Stock hood scoop, and flames and a louvered hood on a '79 Monte Carlo. Staffer Dave Wallace took the California Air Resources Board to task for wasteful spending and ineffectual practices (imagine that!), and Gray Baskerville wrote an awesome piece chronicling his drive with CJ Baker from Memphis to Los Angeles in the Mail Order Street Rod.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1980

60 Years Ago

November 1960: 148 pages, 35¢

Land Speed Racing and its associated technologies were front and center in 1960. Ten pages of the Bonneville National Speed Trials were immediately followed by four pages of aerodynamic theory and test procedures. Drag racers weren't ignored, either, with coverage of the Northeastern Regional Championship Drags in Charlestown, Rhode Island and features on Joe Tucci's supercharged Hemi dragster, and a tech article about installing quick-change rear axle housings. Pontiac had big bucks to spend, as evidenced by the 16-page ad featuring the brand-new Tempest, with it's half-a-V8 four-cylinder engine (the pistons, connecting rods, and oil pan all carried over from the V8), and rear-mounted transaxle boasted 50/50 weight distribution and excellent performance, given the car's 2,900-pound curb weight. That was in addition to the four-page road test of the Tempest by tech editor Ray Brock earlier in the issue.

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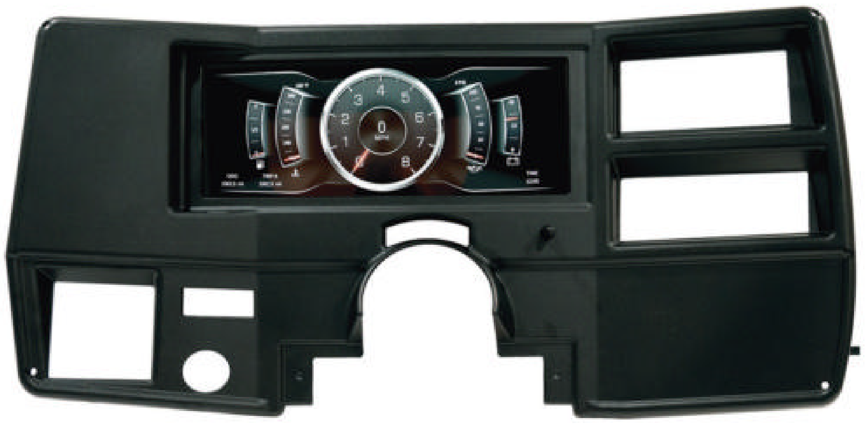

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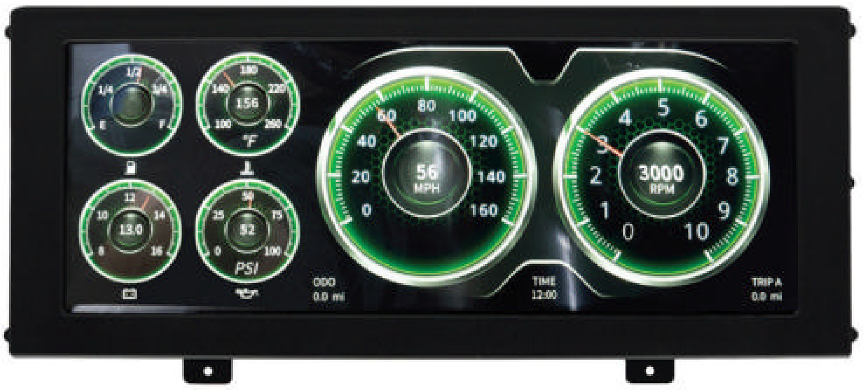

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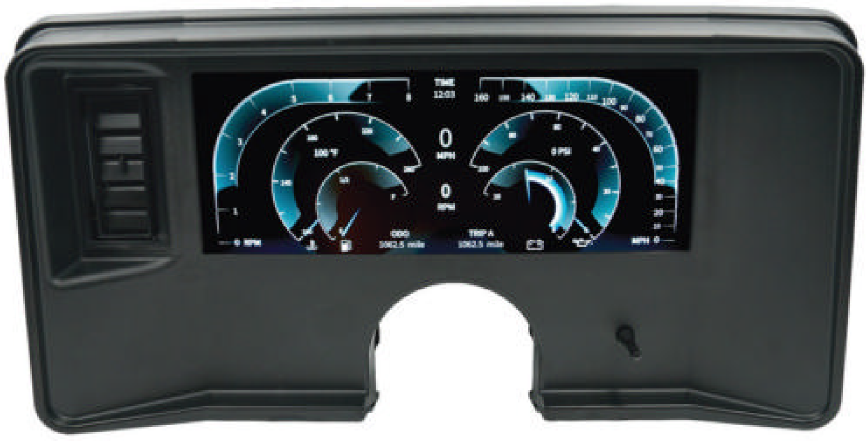

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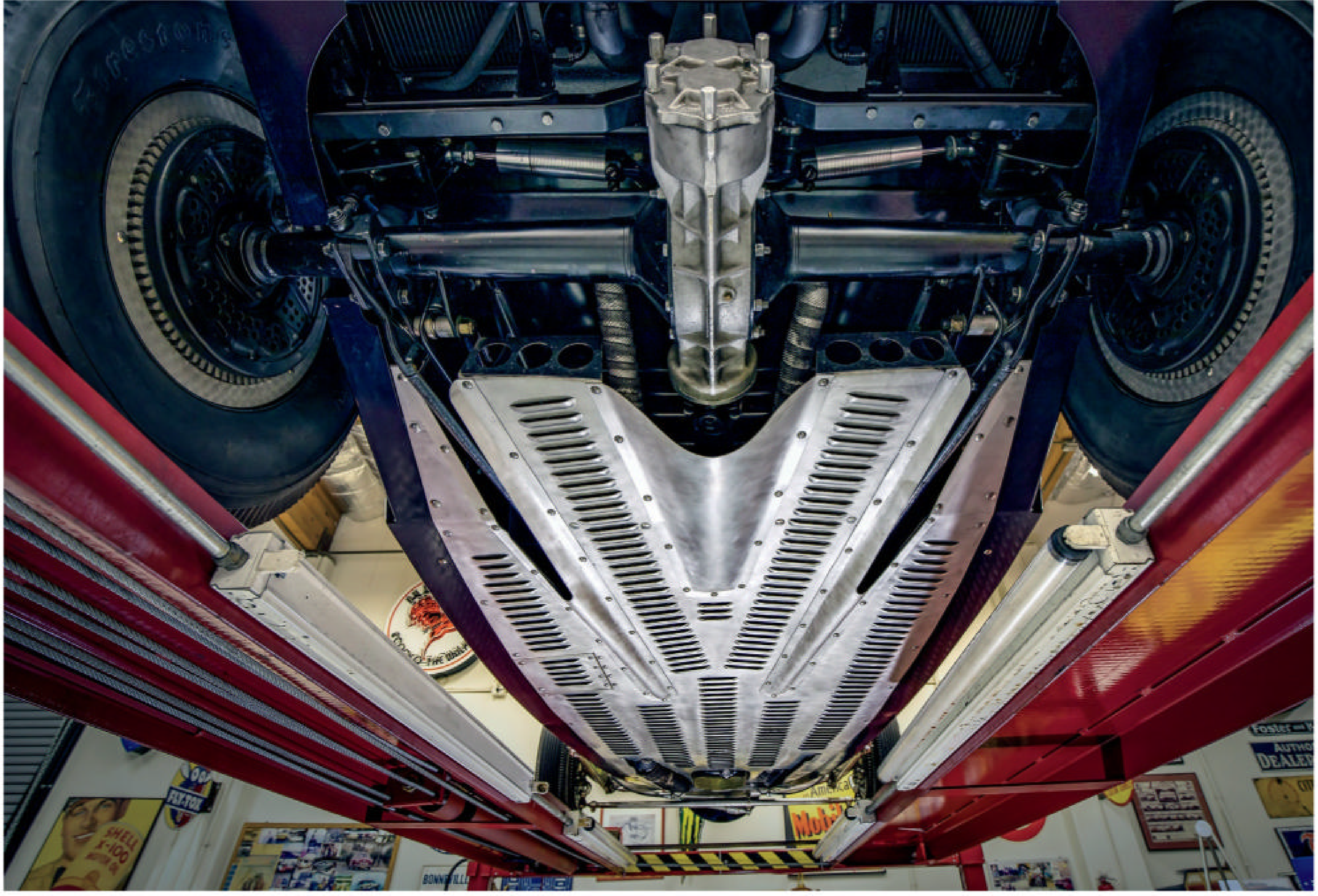
The Rake

Rolling Into the Past With This Nostalgic 1934 Ford Coupe

Dennis Varni, a lifelong Bay Area hot rodder, is no stranger to the world of hot rodding . . . any part of it. He has tried the likes of Bonneville, vintage Mexican and European road racing, and, of course, the Grand National Roadster Show, where in 1991 he won the pinnacle of rodding awards, the America's Most Beautiful Roadster trophy. Considering those credentials, what has Dennis been up to lately? Look at this 1934 Ford three-window fenderless coupe, and you will get a good feel for where his rodding roots are taking him now. His garage is neatly parked with a handful of hot rods that came out of Rolling Bones Hot Rod Shop (RBHRS) in New York. Nowadays, Dennis is into hot rods with a nostalgic patina appearance and has come up with a handful of them from the watchful eye of the Rolling Bones crew.

Brian Brennan Michael Christensen



THE RAKE

The 11-month-long build on this 1934 Ford three-window fenderless coupe was handled by Rolling Bones and is the realization of a lifelong dream. It all started when Dennis was sitting on the bus on the way to school and daydreaming out the window when, there it was: a 1934 Ford hot rod.

Dennis turned over to RBHRS an extremely cherry-looking 1934 Ford thee-window fenderless coupe, and thankfully, the sheetmetal required a minimum amount of bodywork to bring it to its present state. The most challenging part was getting the grille squared away, and the first drive was an "expedition" as there were no brakes. All in all, there was nothing Varni would do over.

The 1934 Ford chassis was pieced together by RBHRS on a 106-inch wheelbase. The rear end is based on a Halibrand Quick Change (with a 1936 Ford axle tubes), then fitted with a 4.11:1 ring and pinion. The rear suspension includes a Panhard bar,

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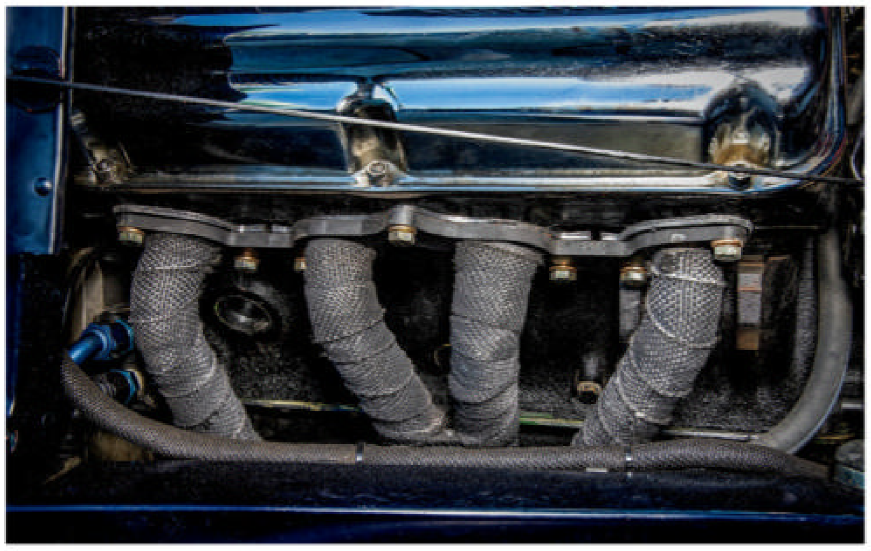
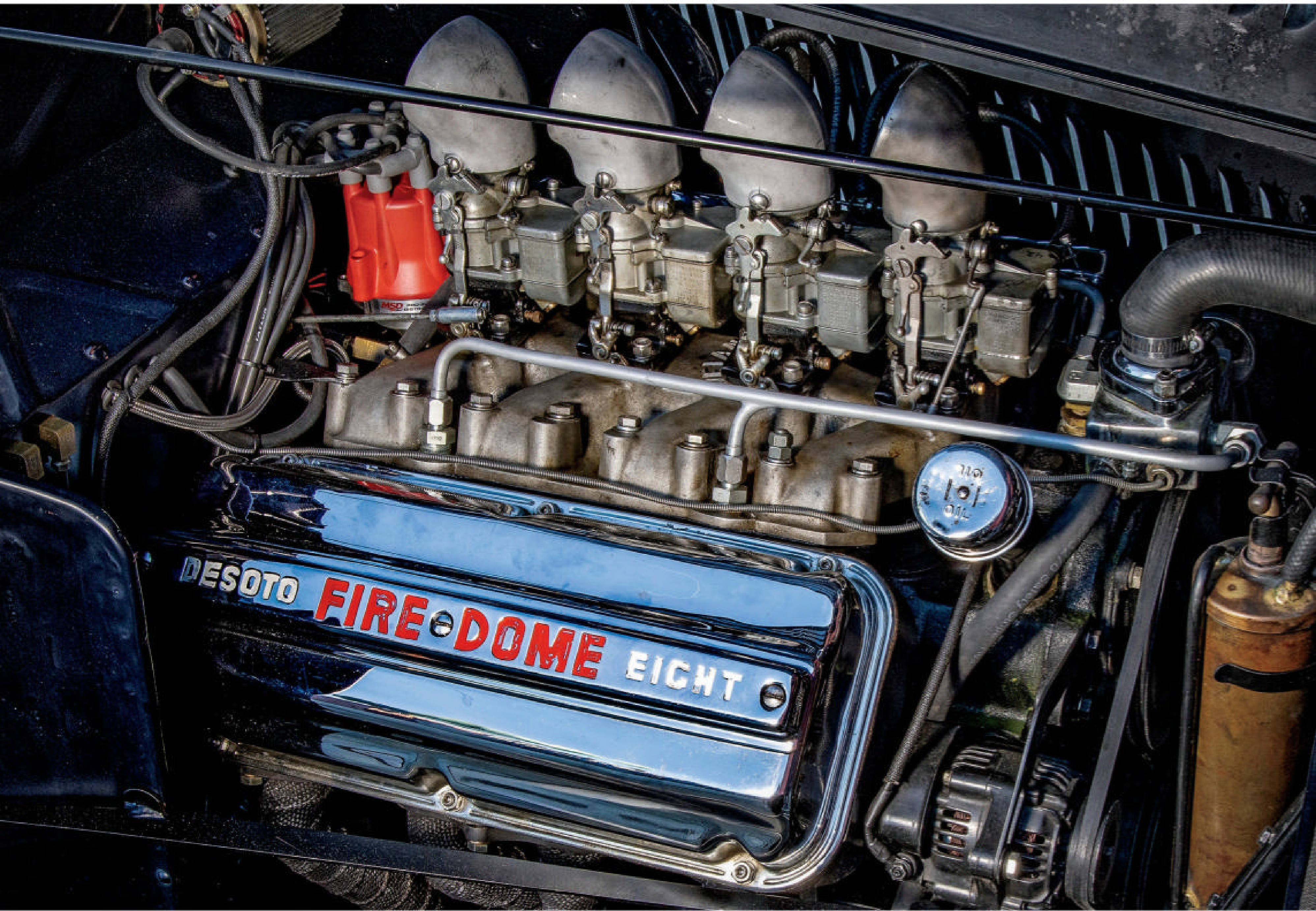
torsion bars by Joe Casanova, QA1 adjustable shocks (minus the coil springs) inboard and laid out at opposing angles. The rear brakes are 15-inch Ford-Lincoln drums. In front, the suspension is based on a Casanova torsion bar with early Ford spindles, split wishbones, a Panhard bar, inboard QA1 shocks, Schroeder cowl-exit steering linked to a Ford steering column spun by a '39 Lincoln wheel and fitted with a 1934 Ford ignition key switch. The vintage chassis rolls on Coker's Firestone Deluxe Champion rubber measuring 4.50x16 in front and 7.50x16 in back wrapped around 4x16-inch front wheels and 6x16-inch rear wheels with spun aluminum wheel covers.

The powertrain begins with a "little" 1954 DeSoto 272-inch Hemi pumping 290 hp and 270 lb-ft. The V8 is cooled by a Casanova brass radiator with an electric fan. A little extra oomph comes via a Racer Brown cam, while the V8 is topped by an inline four-carb intake manifold sporting four Stromberg 81 carbs dressed in mini fresh-air





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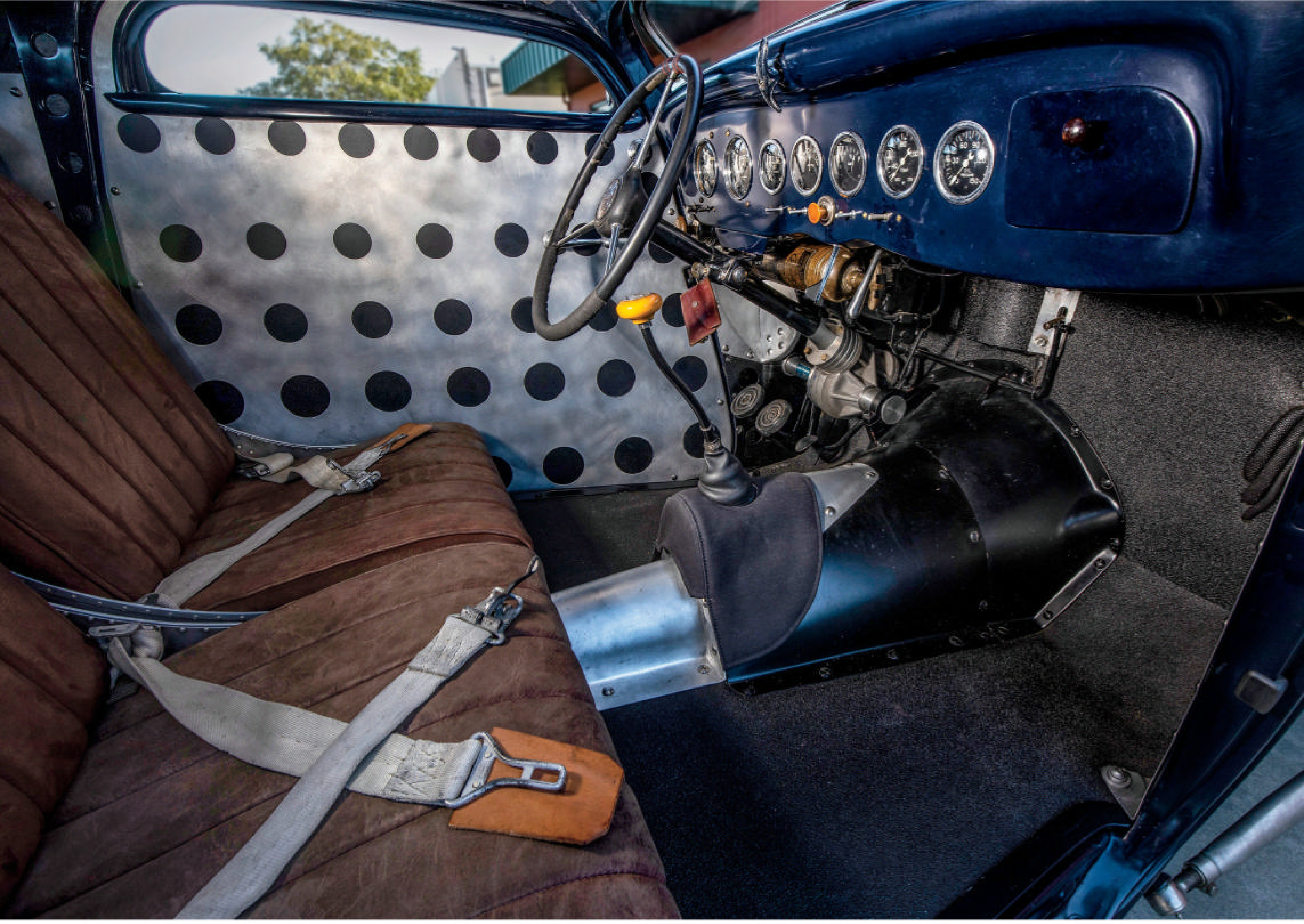

scoops, which complement the chromed stock Firedome valve covers. The ignition begins with an MSD coil and distributor, while a modern-day alternator is spun into service. RBHRS made the custom headers. The transmission is a concession to today's technology as it's neatly hidden between the 'rails and beneath the sheetmetal. The trans comes by way of a '92 Chevy S-10 five-speed giving the fun of three pedals and the luxury of an overdrive for those highway hauls.

While the sheetmetal gives off the age-old patina appearance, in the semi-flat blue hue by RBHRS, the fact remains that it's been severely chopped (often called a Bonneville chop because of its extreme cut) with all the metalwork handled at RBHRS. There are a handful of other body mods coupled with the stock 1934 Ford coupe hood wrapped around a '47 Packard grille. The hood, roof, decklid, and

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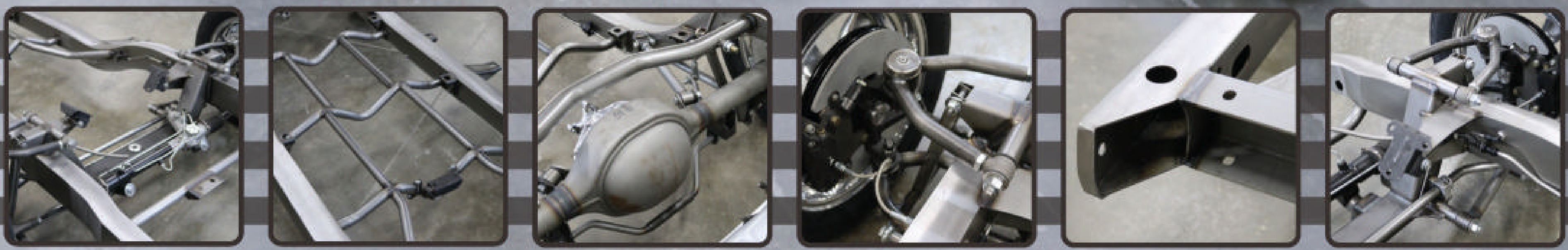
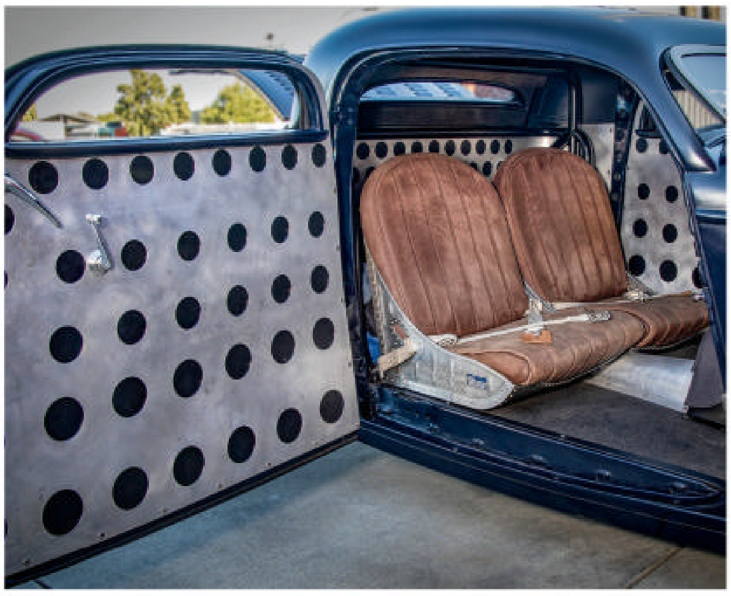


precisionhotrodsandfab.com • 330-908-0234 bellypan have been given the max-louver treatment with far too many punches to count. Lighting the way are small tractor headlights, while bringing up the rear are early Chevy taillights. If you like punched louvers, you will really enjoy the extreme number of holes punched into the inside door panels and the bulkhead that rests directly behind the pair of bomber-style bucket seats upholstered in brown reindeer hides. Rubber mats line the floor, and there's a touch of nostalgia in the "simple" roll bar that's bent into service along with the vintage seven-pack of gauges.

We are willing to bet this won't be Dennis' last attempt at an early hot rod. If history is any teacher, we know there will be all sorts of things automotive in his future. Which is great news for us.



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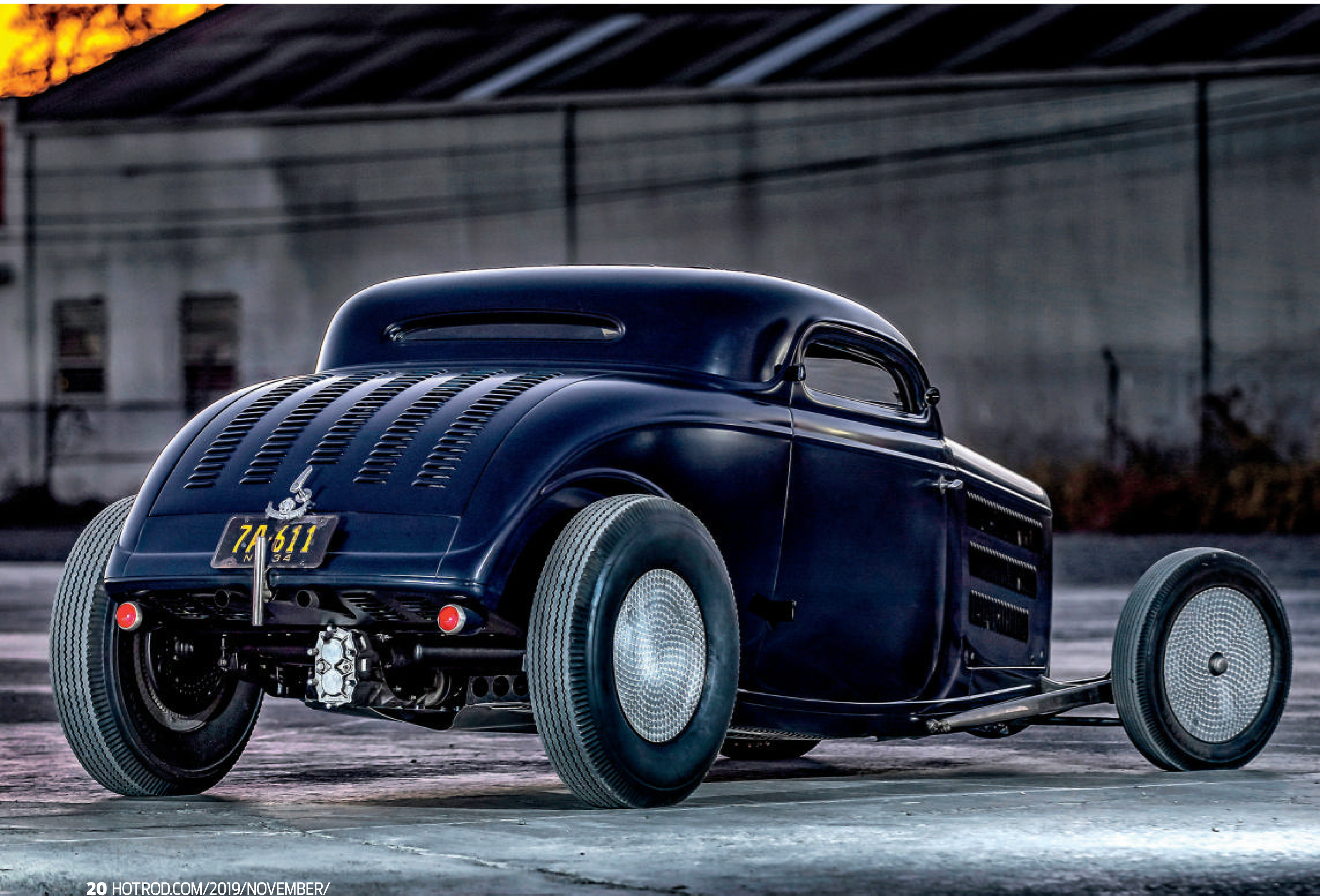

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THIS PRO MOD '67 MUSTANG PULLS MORE THAN 3G OFF THE STARTING LINE AND CAN RUN THE EIGHTH-MILE IN 3.66 SECONDS.

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What's it like to make a pass in a really fast race car? Aaron Wells, owner of this Pro Mod 1967 Mustang, gave us one of the most succinct descriptions we've heard in a while. Running in the Mid-West Pro Mod Racing Association, his supercharged Mustang has run a best time of 3.66 seconds at 209.75 mph in the eighth-mile.

"Before each run, my dad and my friend Travis Cannon check the track to make the final decisions on the tune. When the car fires, I put it in high gear, roll through the water, and nail it. It's a rolling burnout; I don't use a line lock. At the end of the burnout, I go to neutral and hit the transbrake to engage reverse. I hold the reverse handle all the way through the backup. We adjust the wheelie bars, my dad will have me lined up, and just before I pre-stage, we spray deicer on the injector hat. The air moving around the throttle blades can cause ice to build up, which I can feel in the pedal because it sticks, and that's bad. With the throttle free, it will idle nicely around 2,200 rpm.

Evan Smith & John McGann Dominick Damato

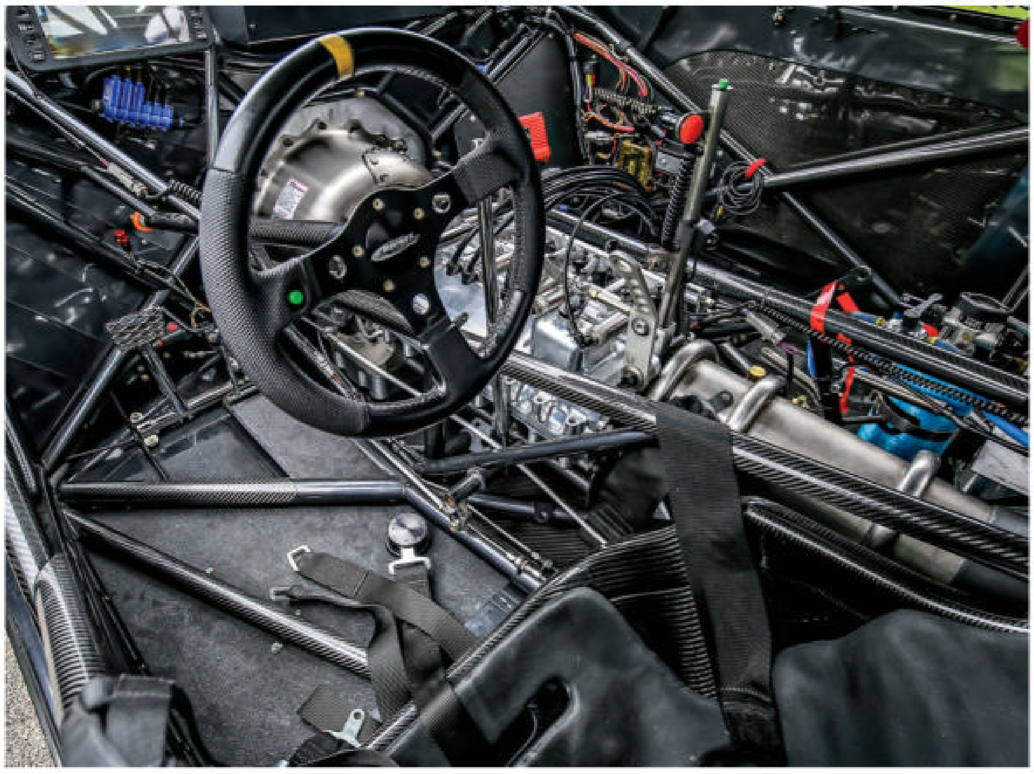
GUIDED MISSLE

"Next, I flip a toggle switch that drops the Liberty in low gear. I can feel when that happens. I pre-stage, then inch forward with the hand brake. Once I'm staged, I hit the transbrake button and floor the throttle. The moment I see yellow, it's go time, and I send it. It's that simple," he says.

At that point, Aaron is experiencing nearly 3g of acceleration. He covers the first 60 feet in just 0.930 second, and then the shifts start coming. "It starts moving hard right out of the hole, and it's usually nice and smooth. When the lockup comes in, it picks the front wheels off the ground, and it will do that about three different times." The computer handles the shifts based on rpm, and it's programmed to execute the shifts at 9,500 rpm. Based on his elapsed times, you can imagine how quickly the car covers the 660 feet to the finish line where he pulls the parachute handle.

A drag racer for many years, Aaron got his start while in college. "Years ago, my father, Steve, and I built a 10-second 1969 Camaro for a local class called Quick Street," the 38-year-old says. "It was a Pro Street-style car that we ran on pump gas at the local track near our home in Oklahoma City. It was mostly local heads-up Outlaw racing, and we did it for fun and so we could race together. We wanted to go a little quicker, so we moved up to Top Sportsman and raced in the Pro Street Racing Association series. We got a different 1969 Camaro, added nitrous, and ran both quarter-mile and eighth-mile events. It would typically run 6.70s at 210 mph in the quarter and 4.35 in the eighth-mile."

Aaron wheeled the Top Sportsman entry to a pair of championships in this series before switching to a Jerry Bickel 1968 Camaro in 2008. At the same time, Aaron decided to run American Drag



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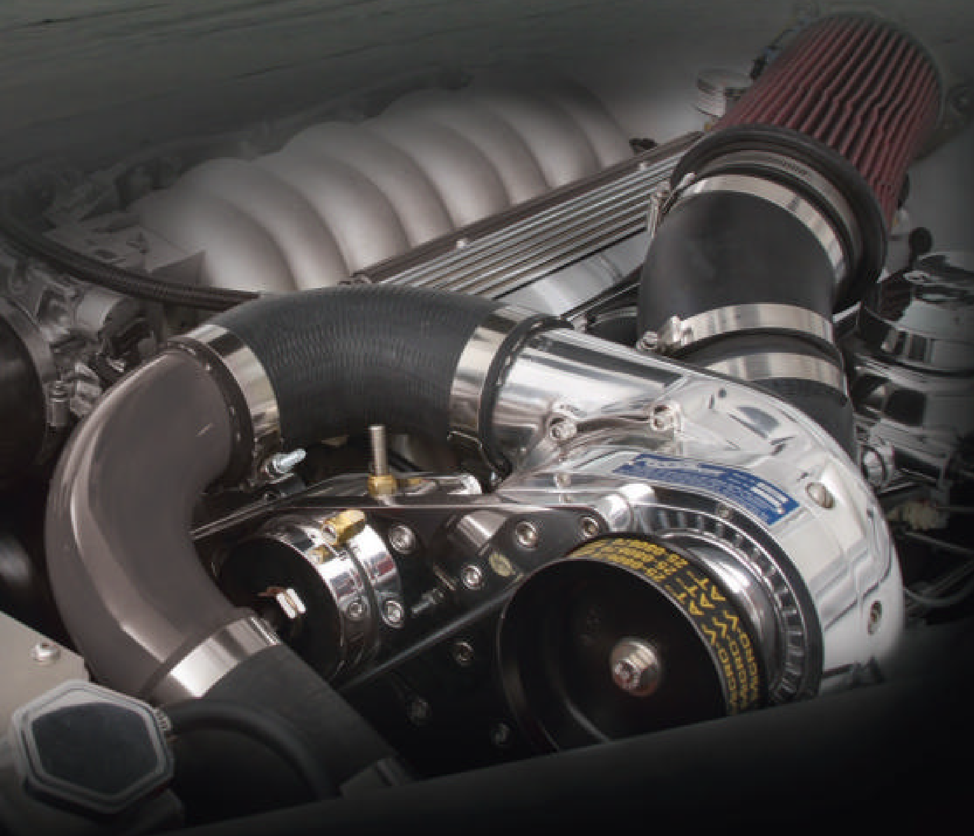

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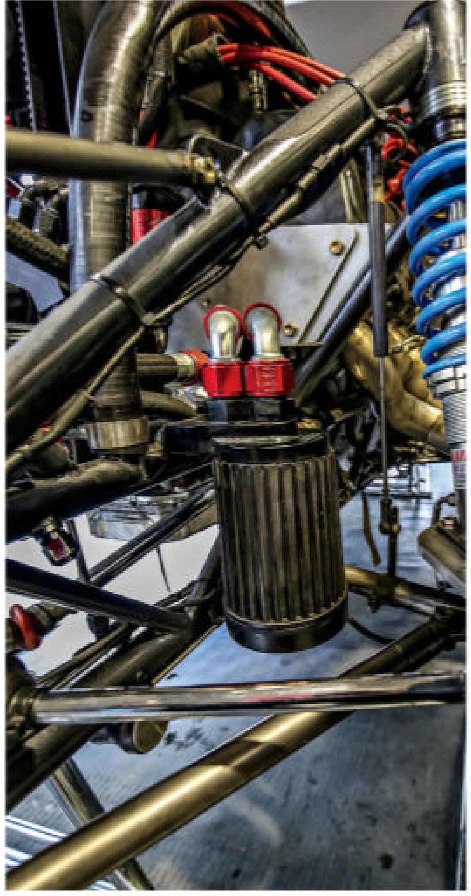
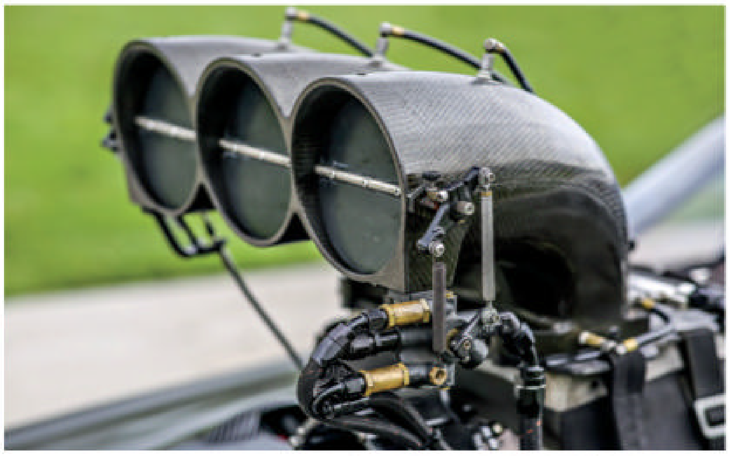




Racing League (ADRL), which, according to him, was in its heyday. "We wanted to go with a purpose-built race car at that point, so we got the Bickel Camaro and started racing. We ran ADRL and then mostly Outlaw-style racing until the Mid-West Pro Mod Racing Series (MWPRMS) got going. "We've been racing MWPMRS since it began," he adds. "It got started with the Throwdown in T-town around 2010 in Tulsa. Keith Haney built the series and expanded it from just two races."

Looking for better performance, the team debuted this new Jerry Bickel Shelby GT500 Ford Mustang in 2017 to take advantage of the latest MWPMRS rules. "My dream car has always been a 1967 Shelby GT500," Aaron says. "I always wanted that body style. I love it in street car form and on a Pro Mod. Of course, after always racing Camaros, no one could believe it when we went with a Mustang.

"The Jerry Bickel Mustang has been absolutely perfect," The car is extremely consistent, and we have a high percentage of successful passes."

"The Jerry Bickel Mustang has been absolutely perfect," he exclaims. "The car is extremely consistent, and we have a high percentage of successful passes." Successful indeed, as Aaron went on to win the MWPMRS championship for the 2019 season.

"The series is fantastic," Aaron adds. "You have a huge variety of body styles, and all three engine combinations are competitive. Originally, I wanted to run nitrous, but we switched over to the screw blower, and it's been wild. Our success really comes down to a team effort. I have a unique crew made up of my family and friends. Everyone is involved, including my wife, Charity; my mom, Beckey; good friends, Travis Cannon, who helps me tune, and Tanner Allison who does anything necessary. Plus, my sister and her husband, Leslie and Scott, also help out."

Powering the Shelby is a 521ci all-aluminum supercharged engine that towers over the Le Mans–striped hood. "We have two engines. Both have billet aluminum Brad Anderson blocks and heads, but the heads are massaged by DMPE." Forced air is provided by the massive PSI screw-type supercharger that mounts to a BAE intake.

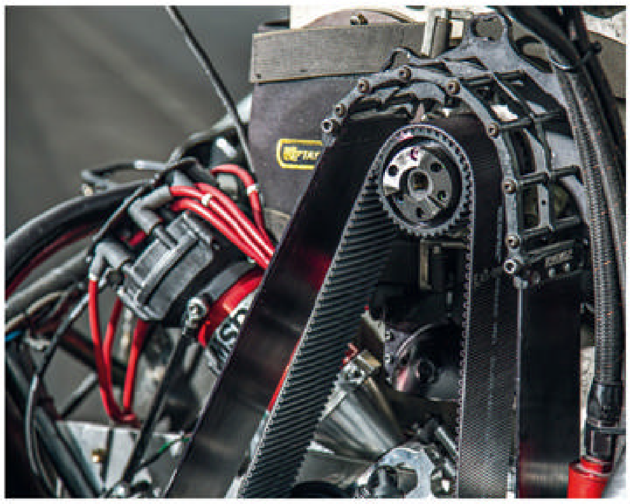
"We're limited to 92 percent overdrive on the supercharger, so that limits it to 50-55 psi of boost," Aaron told us. It's fed a strict diet of methanol and generates an angry 3,000-plus horsepower. All those ponies travel through a Quick Drive lockup converter connected to an air-shifted Liberty five-speed manual transmission.

Launch rpm is determined by the setting in the MSD, and the amount of power used on launch is controlled by the timing map. The team can also change transmission ratios to work with varying track conditions.

Out back is a Jerry Bickel fabricated housing that's based around the Ford 9-inch architecture with a DMPE centersection. Like most tube-chassis cars, the Mustang uses adjustable Lamb coilover front struts with specific-rate springs. Out back are four-link Penske coilover shocks, a massive Pro Mod antiroll bar, and Lamb brakes.

The rolling stock is a combination of Weld Wheels with Goodyear rubber up front and American Racing 16-inch wheels with Hoosier 36x17 slicks out back. The body is a carbon-fiber replica of a 1967 Shelby GT500 that came from Tim McAmis Race Cars. It's painted a variation of Ford's Dark Shadow Gray Metallic with a hint of gold flake, and those classic Le Mans stripes were done with a carbon-fiber look.

"It's been an incredibly consistent combination," Aaron says. "We'll adjust timing and fuel mapping to compensate for changing air and track conditions, and at times, we use five stages of lean-out to keep the fuel where we want it. We run a single Rage fuel pump that's driven by a gear off the front of the engine, and we can leave fuel in or take it out by opening or closing jets to prevent it from blowing up. Ultimately, we've got more horsepower than most tracks can handle," he explains. □



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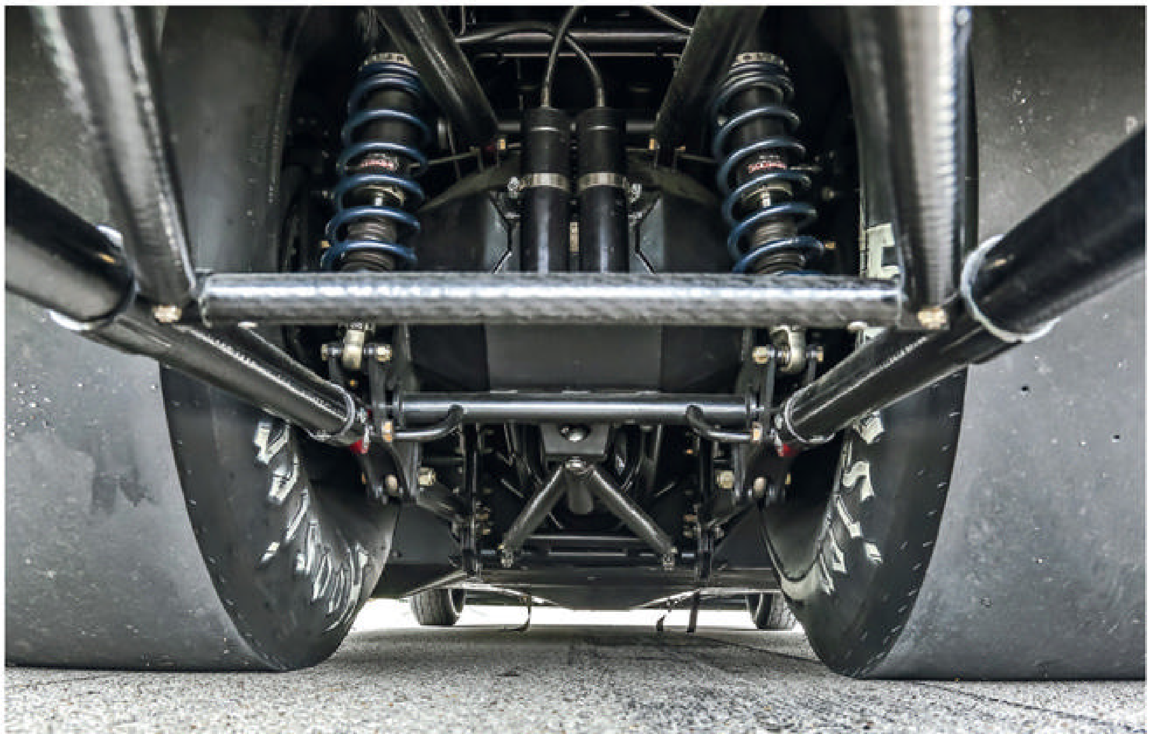

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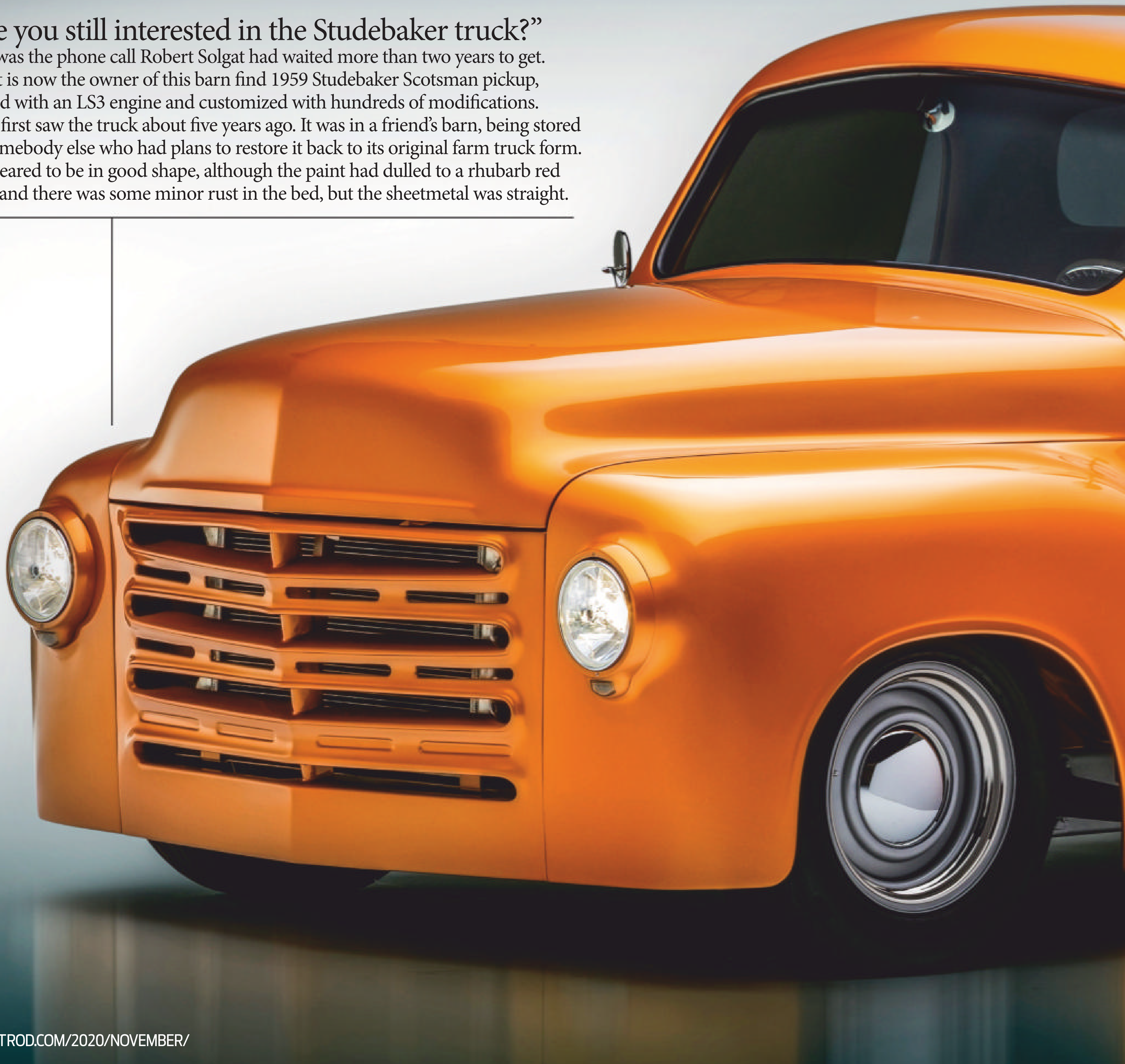
A SCOT'S HONOR

Persistence Pays off With the Build of this 1959 Studebaker Scotsman Pickup

Tim Bernsau Jorge Nunez

"Are you still interested in the Studebaker truck?" That was the phone call Robert Solgat had waited more than two years to get. Solgat is now the owner of this barn find 1959 Studebaker Scotsman pickup, packed with an LS3 engine and customized with hundreds of modifications.

He first saw the truck about five years ago. It was in a friend's barn, being stored for somebody else who had plans to restore it back to its original farm truck form. It appeared to be in good shape, although the paint had dulled to a rhubarb red color and there was some minor rust in the bed, but the sheetmetal was straight.



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"You don't see a lot of these trucks, so of course I really wanted it, but my friend said it wasn't for sale," Robert told us. "That wasn't the answer I wanted to hear, so I kept asking about it every time I was at my friend's house. The answer was always the same, and I was reaching the point of accepting that I would never own the truck.

Patience Rewarded

Robert backed off and started thinking about looking for something else. About five months passed when he got the phone call he'd been waiting for and the answer he wanted to hear. He wasted no time in striking a deal with the owner and towing the Studebaker home.

The 3½-year project that followed was completed partly at home by Robert and his son, Dallas, and in large part by JV Enterprises in Azusa, California. Robert had worked with Vince Borzillieri and his JV Enterprises crew on a 1935 Chevy coupe a few years ago and was eager to have him apply his talent to the Studebaker. The Scotsman pickup, offered in 1958 and 1959, was Studebaker's economical, no-frills alternative to its Transtar model. Robert and Vince were about to turn this one from straw to gold.

Building the Foundation

After JV Enterprises did the preliminary modifications to the factory frame to make it square, box the 'rails, and C-notch the rear for a low custom stance, Robert and Dallas took the bare frame and suspension components to Azusa Refinishing Company for powdercoated. Everything was assembled into a rolling chassis back at Robert's garage.

Danny's Original Customs provided the Mustang II style IFS, complete with 2-inch drop spindles to further the on-the-ground posture. Front and rear Aldan American adjustable coilovers help the Stude ride smooth. The 8.8-inch rearend was transplanted from a Ford Explorer and features 3.73:1 gears and limited slip, located by a Danny's Original Customs four-link and braced by a Panhard bar. Braking is provided by a combination of Explorer front discs and

STUDEBAKER

Camaro 12-inch discs in back, plumbed to a Corvette dual master cylinder and dual 8-inch vacuum boosters, along with a Wilwood proportioning valve.

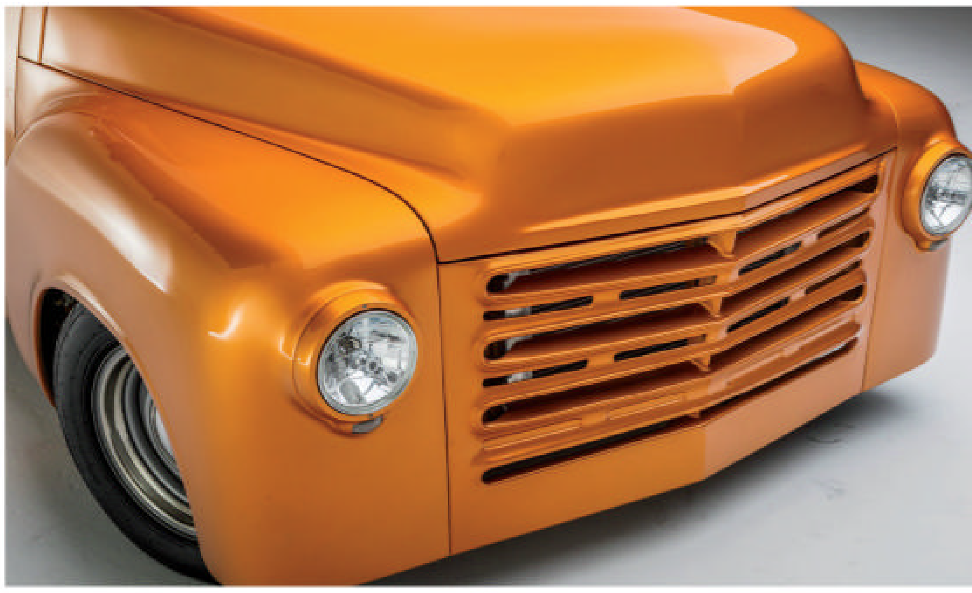
Sheetmetal Shaping

Back at JV Enterprises, Vince and his fabricators were working every inch of the Studebaker's body and bed. The shop has a reputation for extensive and just-right sheetmetal mods, and Robert's Scotsman is a prime example of that talent. The doors and driprails were shaved, but that was just the beginning. After the bumpers were eliminated, rollpans were fabricated. In front, the lower portion of the fenders was extended downward 6 inches and smoothed. The grille was extended to follow the fenders, and an additional grille opening was fabricated.

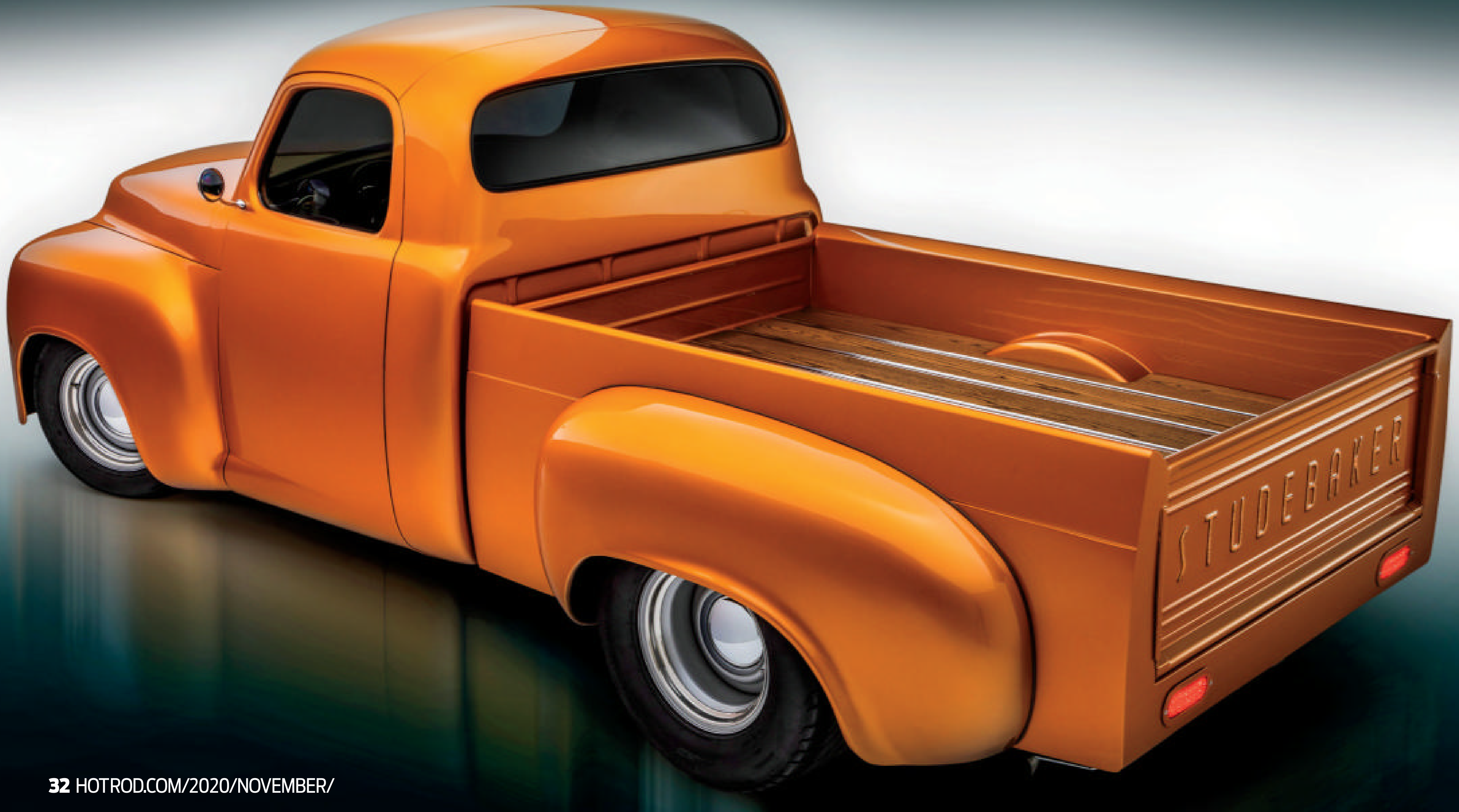
Further back, the bed was customized with smoothed sides and filled stake pockets. The tailgate was restyled and moulded shut. The stained oak bed floor was raised 5 inches, and custom wheel tubs were added to fit the upgraded tire and wheel combination. Exterior additions include tri-bar headlights and oval LED taillights, one-piece door glass, and 1934 Ford coupe side mirrors.

Custom Paint and Hot Rod Rolling Stock

When it was ready for paint, the Scotsman was sprayed with a custom mix of Axalta paint called Sunburst Orange Metallic. Larry Fator from Quicksilver contributed the perfect finishing touch to the tailgate, with some extraordinary gold leaf airbrush art.



The shop has a reputation for extensive and just-right sheetmetal mods, and Solgat's Scotsman is a prime example of that talent.



The tire and wheel selection reflects the Scotsman's classic truck heritage—and complements the rest of the exterior. Fifteen-inch Smoothie wheels from Wheel Vintiques are bundled in fat Mickey Thompson radial tires, measuring 26/8.00R15 and 29/15.00R15.

LS to Impress

The sheetmetal work extends under the hood with custom inner fenders and a filled and smoothed firewall. Dallas and Robert's friend Louie installed the super sanitary 2010 Chevy LS3 engine. The engine utilizes a LS376/480 Connect & Cruise powertrain control system and is dressed up with a custom cold air intake system and Eddie Motorsports coil covers. A Northern Radiator triple-pass aluminum radiator keeps the LS3 plenty cool. A MagnaFlow exhaust system including stainless pipes and mufflers carries away the gases. The 4L70E transmission has been modified with an electronic shift controller.

Incredible Cab

The cockpit is covered in distressed Carrera Tan Allante vinyl. Even the smoothed custom dash is upholstered and houses a 5-inch speedometer/tachometer combination and quad gauge from Auto Meter's American Muscle series. A Kenwood Excelon Navigation DVD receiver provides audio, Garmin, Bluetooth, and other functions and is wired to front and rear Infinity Primus speakers. The 40/20/40 split bench seat is from a Dodge Dakota pickup. A 14-inch Trinity style steering wheel is mounted on a Racing Power Company shifter column.

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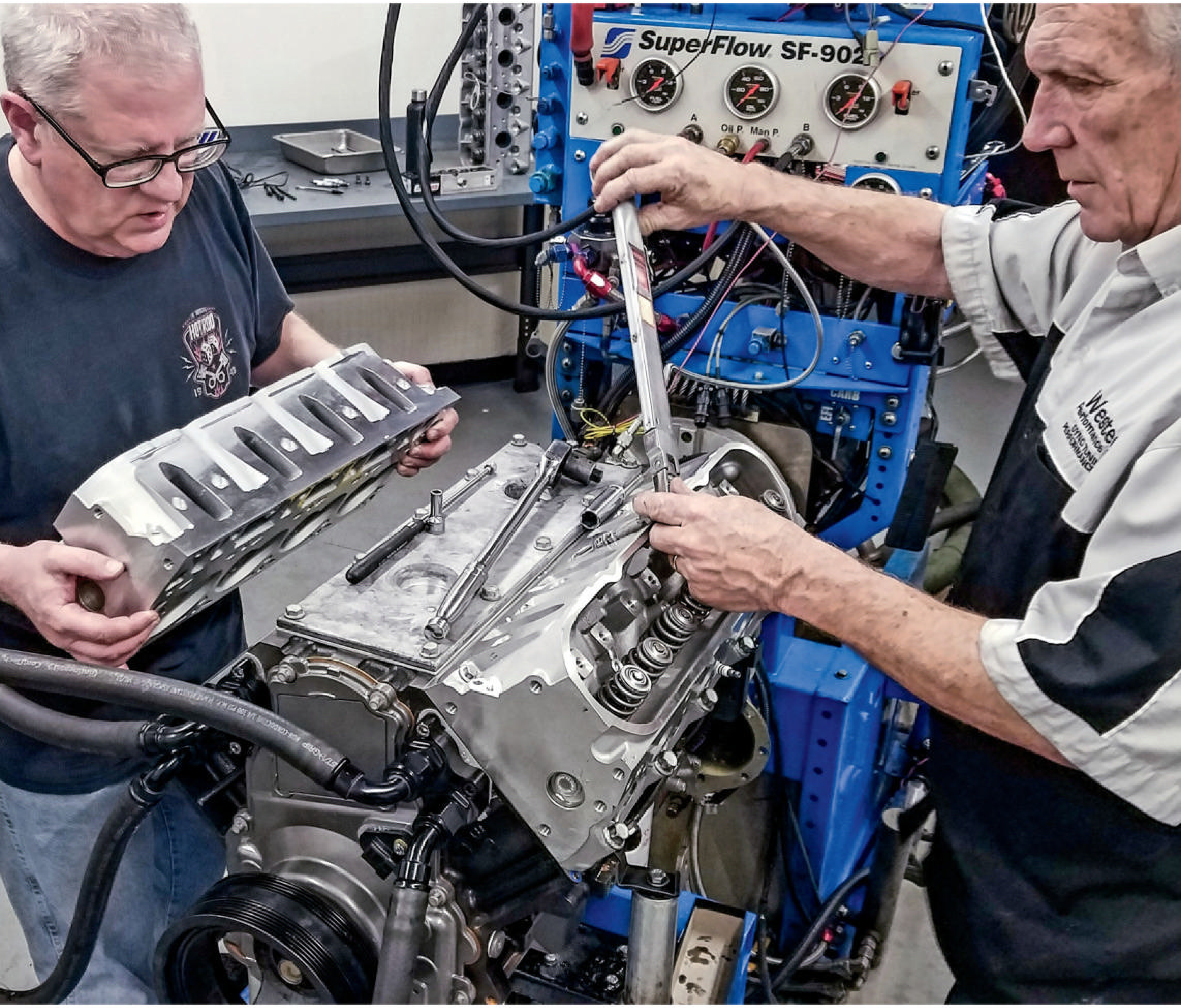


LS CYLINDER HEADS:

SHOOTOUT AND CAM TEST

Johnny Hunkins

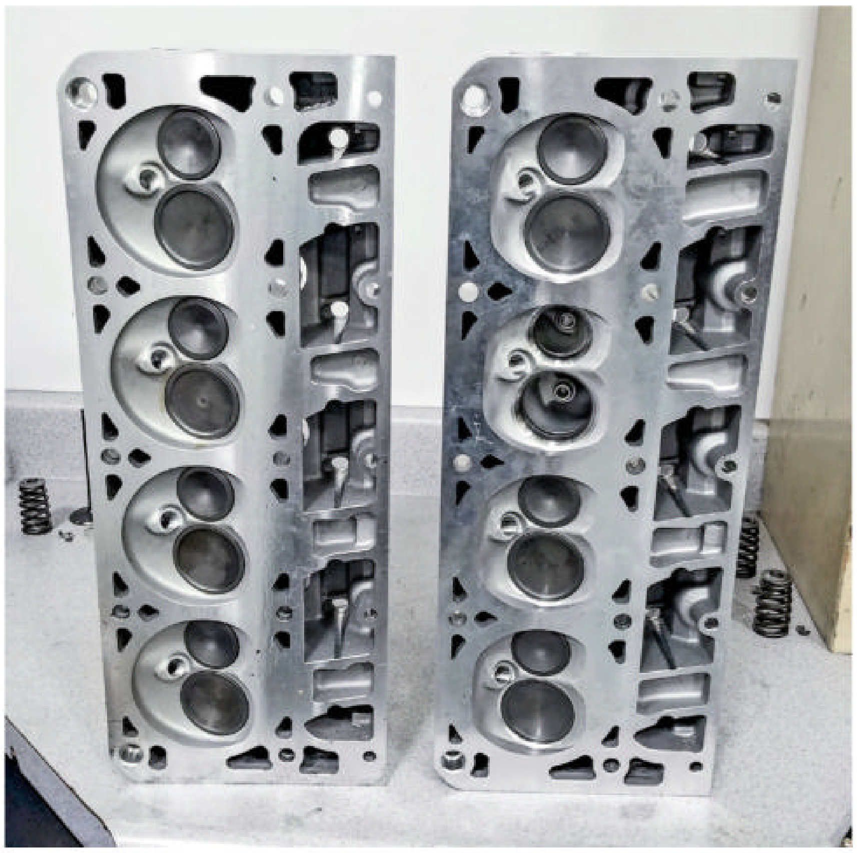
›**More than 20** years after the first Gen III LS1 V8 rolled off the assembly line for the 1997 Corvette, it seems there are LS cylinder heads everywhere, and even more stories that have tested and recommended various performance upgrades in the LS cylinder head department. Layered on top of that is the multitude of variations on stock displacement, port configuration, valvetrain type, and other evolutionary changes that have occurred over the years. It's a jungle out there, and even though the LS is the go-to powerplant for those on a budget, there's a lot of stuff to know before considering a build.

Here, we will dyno test three new LS cylinder heads and perform a camshaft swap on a naturally aspirated Gen III 6.0L LY6 truck engine. We'll be using new stock-replacement cylinder heads sourced from EngineQuest (EQ), a wholesaler that has supplied cores and parts to the rebuilder industry for nearly 30 years.

Westech Performance technicians Troy Goldie and Steve Brulé ready our LY6 6.0L test engine for a dyno run in Westech's SF-902 dyno cell.

Why Use Stock Cylinder Heads?

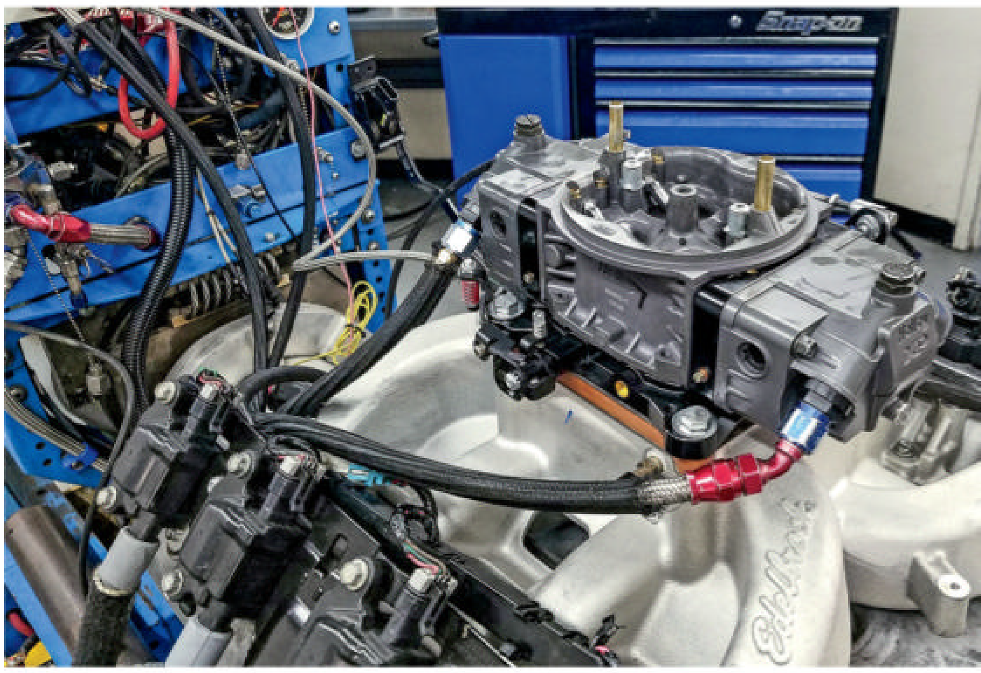
With so many aftermarket versions available, you may wonder why we're focusing on stock replacement cylinder heads. Basically, brand new versions of stock heads are getting difficult to find. More and more, your options are refurbished heads, and hopefully, the rebuilder is a good one. As a supplier of parts for rebuilders in the stock replacement market, EQ is often the first to experience tight supply chains for factory-style parts, even before performance builders.



EQ's factory replacement 317 head (*left*) and 243 head prior to flow testing at Westech. Note the variation in shape and volume of their combustion chambers. Small-chambered 243 casting is a favorite with budget-minded builders.

Scott Stolberg, owner of EngineQuest, says: "We are in the engine core business, so we supply a lot of rebuilders with the cores they use, and through that process, we discovered that there's times we either can't get cores, or we can't get good quality cores. Then we look at, is this an option to make new parts, depending on the volume of the engine that's out there and the potential market."

In the case with Gen III and Gen IV engines, Stolberg says the tipping point came between 18 and 24 months ago and was the impetus for creating the three new cylinder head offerings seen here. Those three new SKUs—the LS3, the 317 casting, and the 243 casting—are designed to cover the majority of all Gen III and Gen IV rebuilder needs for for most LS-based engines.

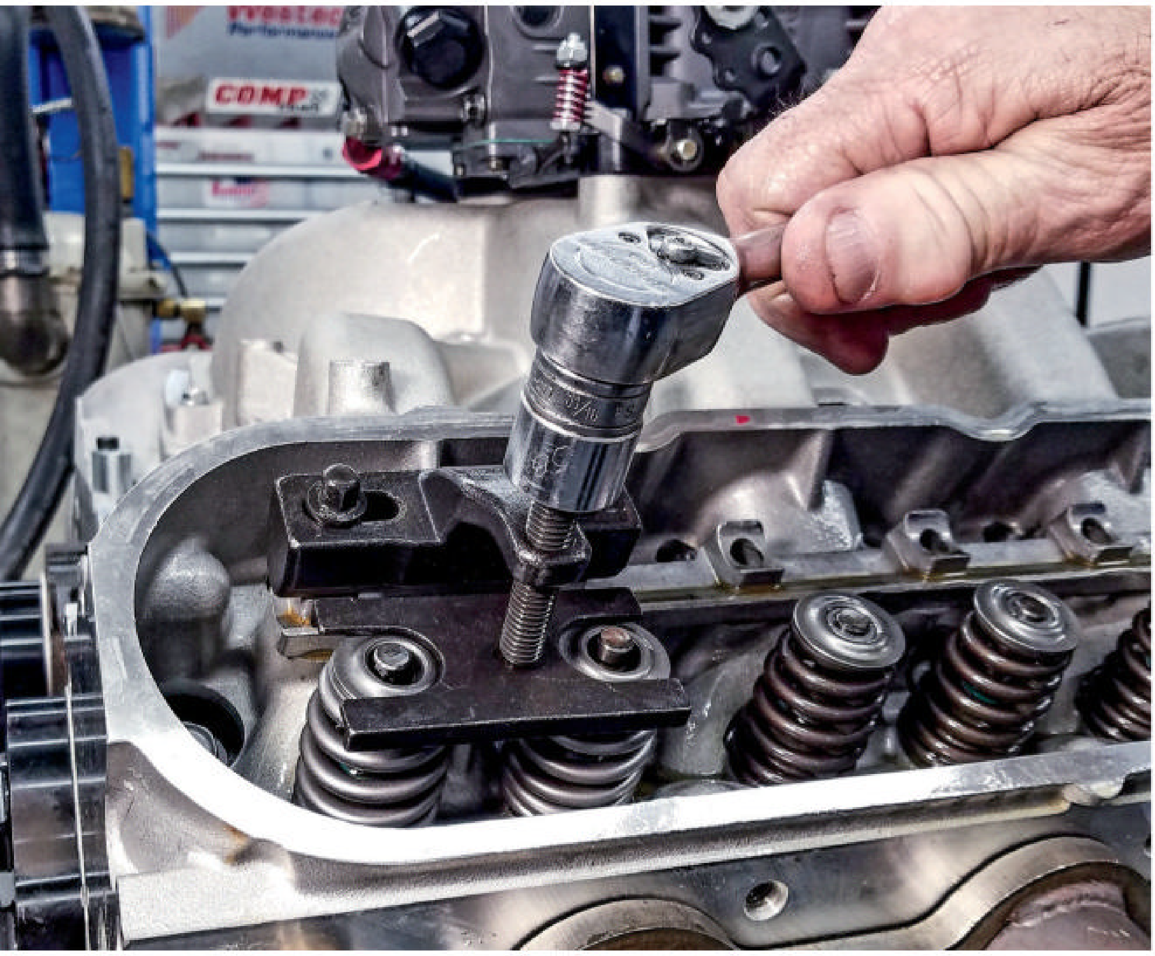


For our test session, we used a Holley XP 750 carburetor to supply fuel. Two intake manifolds were used: the Edelbrock Performer RPM LS3 is shown and was used on the rectangle-port EQ heads, while a Performer RPM LS1 intake was used for the cathedral-port tests.

A comparison of EQ's cathedral-port intake port windows revealed the 317 casting (*left*) to be 3.19x0.965, while the 243 unit was 3.149x1.035. Both ports weigh-in at 211 ccs.

Which Heads are Better, Stock or Aftermarket?

From a pure power standpoint, there's no question a higher-flowing aftermarket cylinder head is better for performance. The harder question might be, is it worth the extra money? With the suggested retail price of a brand-new EQ cylinder head hovering just under $700, sold individually, fully assembled, that may be a decision best left to individual circumstances. As EQ does not sell to the public, but through retailers like Jegs and Speedway Motors, the transaction price can often be considerably less than this.



Performance use of the EQ heads will require a spring upgrade, which we supplied in the form of these Comp Cams 26918 springs. The fixture tool from Comp was a huge time-saver and allows springs to be swapped on the dyno or even in the car.

Valvespring Upgrade

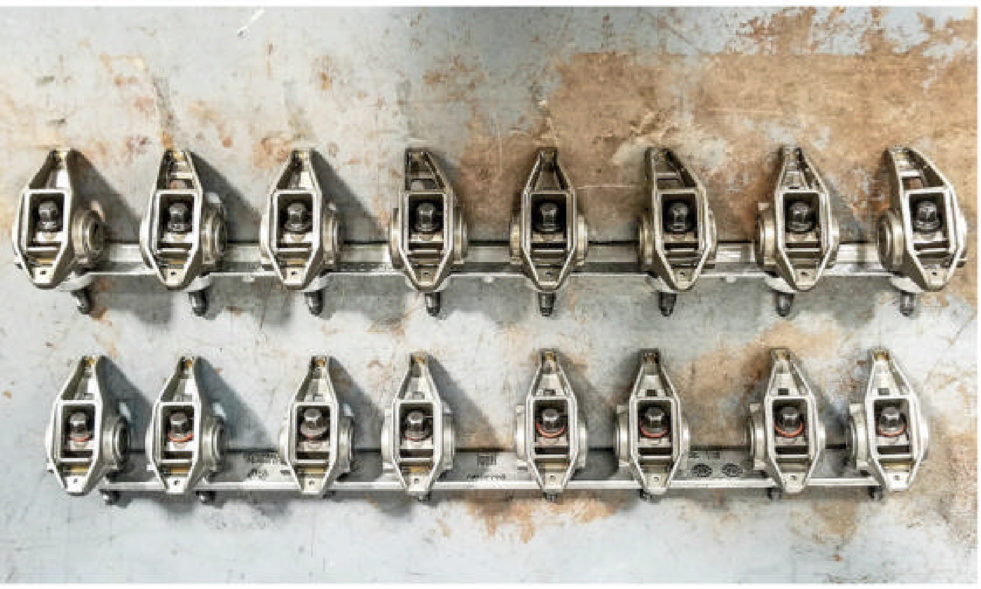
There is also the issue of valvesprings. EQ sells assembled heads with stock valvesprings that have a max lift of 0.480 inch, which is not going to cut it for anything but a stock truck engine. The springs on the three sets of EQ cylinder heads in our test were swapped for a set of Comp Cams 26918-16 coils (street price, $193), which have specs at 125 lbs seat pressure and 367 lbs at 0.650-inch lift. The change was made because we planned to test a pretty sizeable street cam to prove out the airflow capability of these new heads. Note that in the aftermath of our test, we made a plea to EQ to upgrade the valvesprings on assembled heads. They agreed to make that happen, so make sure to inquire about possible spring upgrades before making a purchase.

LS3 Rectangle Port (CH364C)

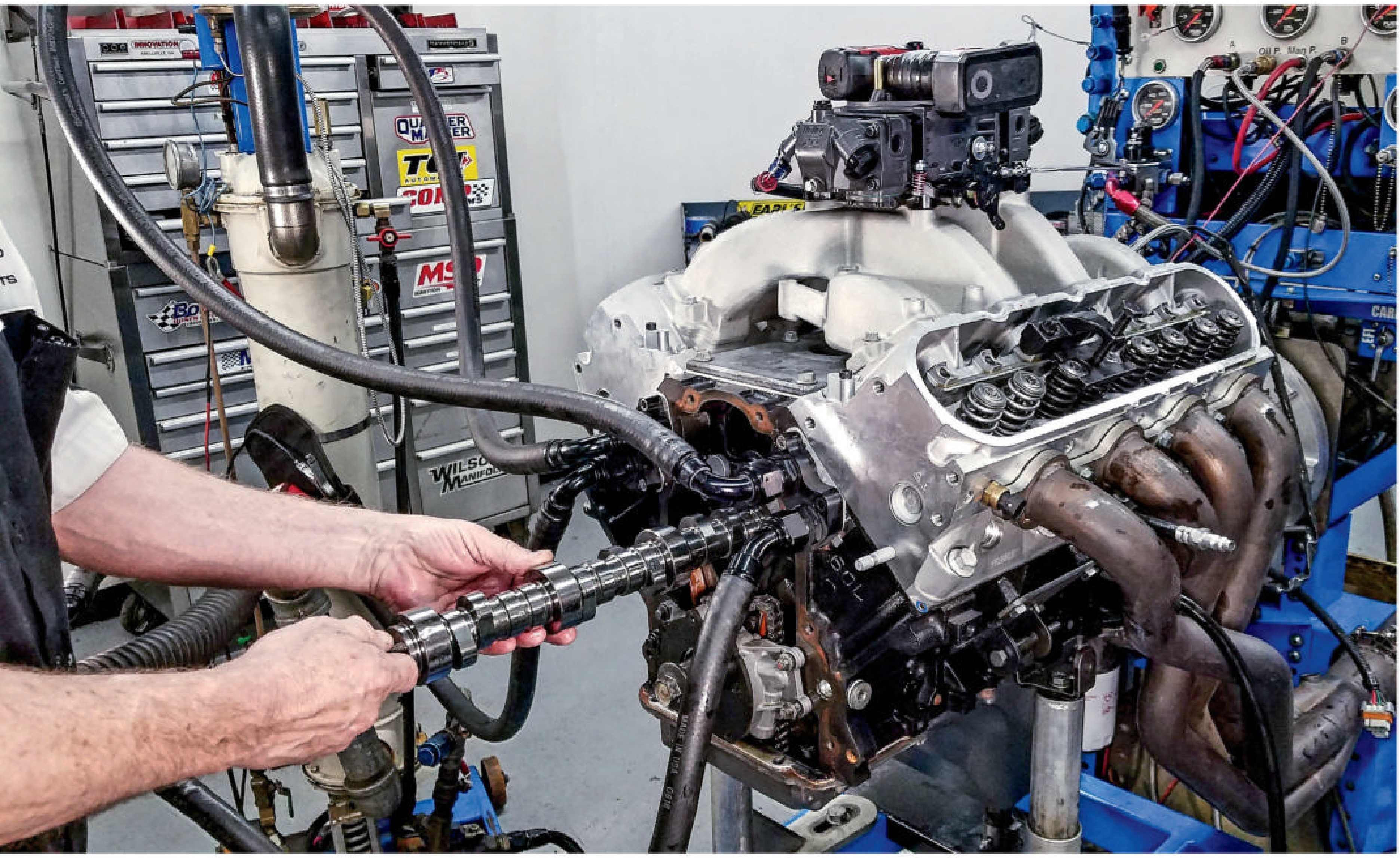
Our test engine was supplied by EngineQuest from an inventory of core engines maintained by sister company A&A Midwest, which is one of the country's largest suppliers of recycled core engines and transmissions. With facilities in Las Vegas and Chicago, their reach is nationwide. Our dyno mule arrived at Westech as an assembled long-block on a pallet with two additional sets of cylinder heads. Moreover, the engine had been dyno tested previously at Shaver Specialties of Torrance, California, so it already had one of the sets of heads—the LS3 rectangle-port Gen IV cylinder head—bolted on, along with an Edelbrock Performer RPM LS3 intake manifold. As an added bonus, we had the dyno sheet from Shaver as a reference for our first test, but before we get to that, let's take a look at the EQ rec-port head.

The LS3 Gen IV is visually differentiated from earlier Gen III siblings by the rectangular shape of its intake port, which measured 2.551x1.248 inches. Intake port volume rings in at a healthy 258 ccs.

EQ's CH364C head (or CH364CA, assembled) ostensibly replaces Gen IV cylinder head casting numbers 364, 716, 821, and 823 in the OE repair/rebuilder world, but performance enthusiasts will know it as the unit that graces LS3 and L92 engines—both 6.2 liters. Its peanut-shaped combustion chamber measured 66 cc, or slightly shy of its typical spec of 68–69 cc. The stainless steel valves provided with the heads measured a stock 2.165-inch diameter on the intake and 1.59 inch on the exhaust, and externally, the cylinder heads of all three versions tested here have a stock appearance, right down to the factory casting numbers and stampings.



***Left:* One of the differences between Gen III and Gen IV engines is the rocker arms. Note the offset intake rocker arms (*top*) in order to accommodate the wider, rectangular intake ports of the Gen IV LS3.**



On our LY6 test engine, the EQ-sourced LS3 heads provided a 9.9:1 compression ratio. With a stock, three-bolt, non-VVT (Gen III) cam with 0.460-inch lift (most likely out of an LQ4/LQ9 truck engine), a Holley XP 750cfm carburetor, and 1 7⁄8-inch long-tube headers from American Racing, the combination made 421 hp at 5,800 rpm, and 441 lb-ft at 3,500 rpm. Compared against our reference dyno sheet from Shaver Specialties (426 hp at 5,800, 442 lb-ft at 4,200 rpm), our opening test matched up well.

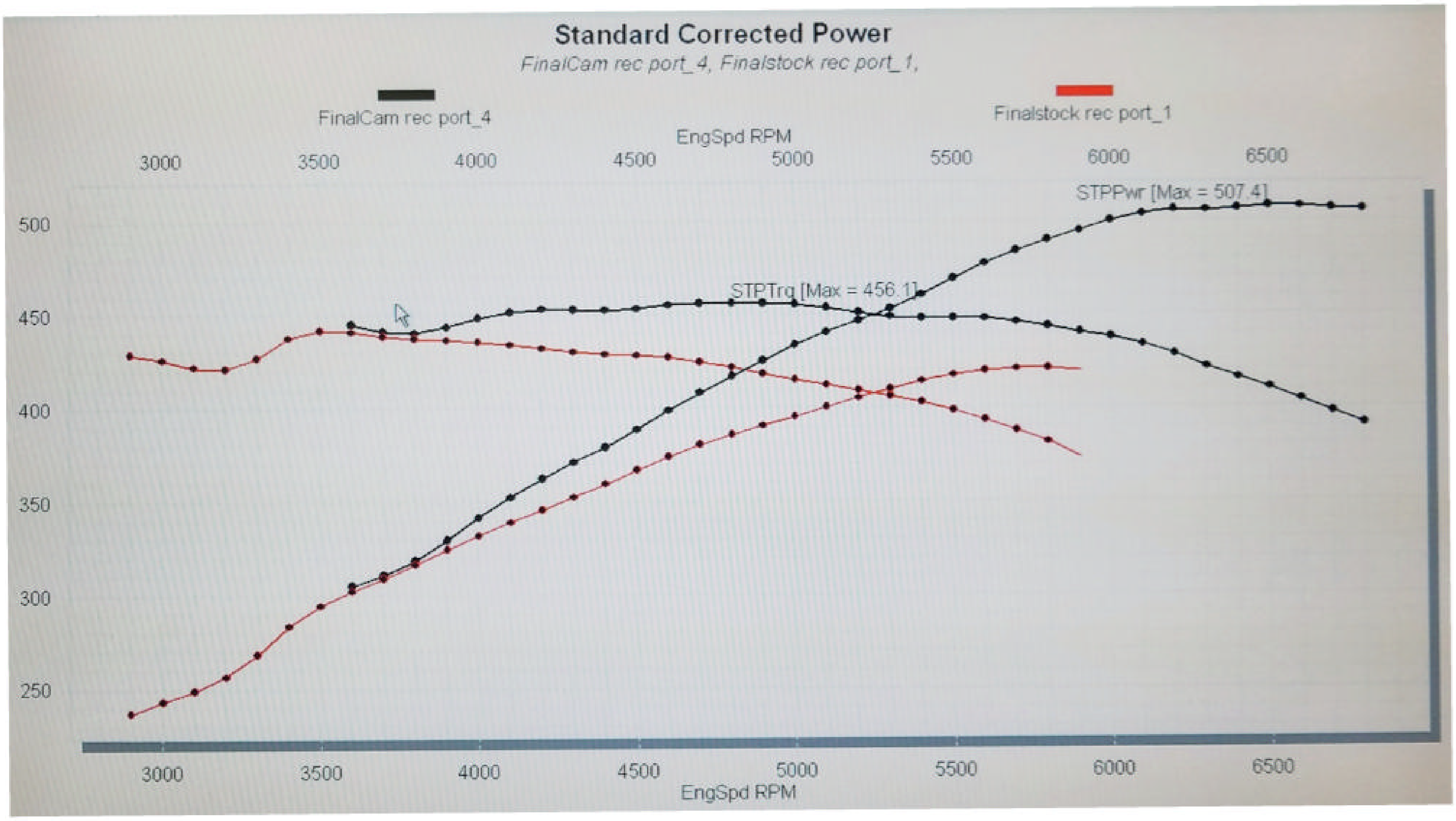
To minimize the effort of swapping heads and cams throughout the test, our first dyno runs were the only ones with stock EQ valvesprings and stock LQ4 camshaft. Our next move would be an upgrade camshaft in the form of a Comp Cams hydraulic street roller (LSR camshaft part No. 54-454-11) with 227/243 degrees of duration (at 0.050-inch lift) and total valve lift of 0.613-inch/0.623-inch exhaust, set on a lobe separation angle of 113 degrees. The cam represents the latest lobe technology for LS engines (specifically the LS3) in Comp's lineup and constitutes what most enthusiasts would consider a max-effort street cam.

Also, because a later-version, non-VVT Gen IV cam cover (supplied new by EQ) was already installed on our Gen III LY6, we were compatible with the three-bolt non-VVT cam, timing gear, and cam sensor designs which changed over the evolution of the LS and which sometimes play havoc with interchangeability.

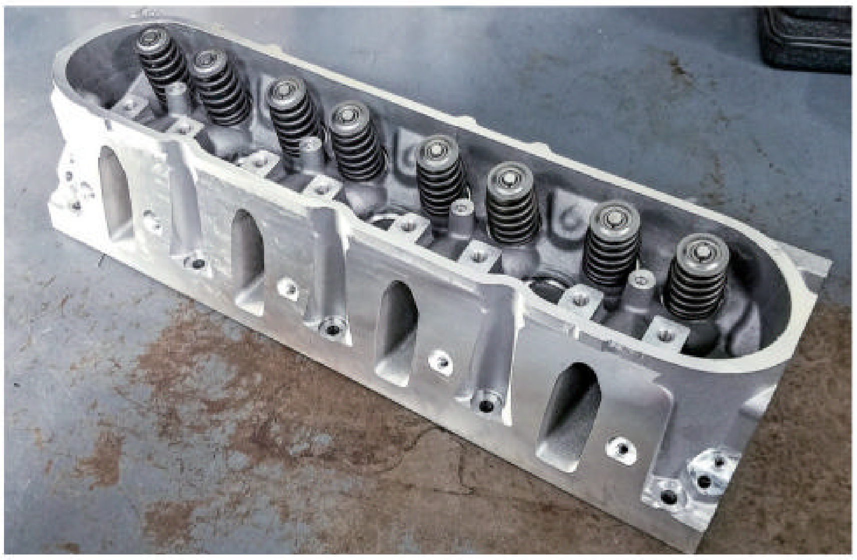
Camshaft Dyno Results

After a couple of truncated dyno pulls to check the air/fuel ratio, we were rewarded with an enormous jump in power. Right from the hit, the LSR cam soared above the stock LQ4 cam, and by the stock cam's

COMP
Performance Group
K&N
Holley
54-454-11



power peak at 5,800 rpm, had bested it by 68 hp, and at its peak at 6,500 rpm had crested to 507 hp—a peak-to-peak gain of 86 hp. That's nothing to sneeze at, considering these EQ cylinder heads hadn't been touched with even a rudimentary valve job, let alone any port work. But how would the cathedral-port heads fare with the LSR cam?



"317" Cathedral-Port Casting (CH364A)

The factory 317 casting doesn't get a lot of love due to its 70cc combustion chamber, nevertheless, it came on a variety of LS-equipped Chevrolet, GMC, and Cadillac truck models (namely the LQ4 and LQ9 Gen III 6.0L) and is frequently sought as a replacement part for rebuilds. In some cases, its lower compression ratio makes it appropriate for boosted performance builds. In any event, its testing here will help illustrate one of the most basic principles in engine building: the effect compression ratio has on power output.

With the Comp LSR camshaft still installed in the LY6, the rec-port LS3 heads and intake were replaced with the cathedral-port 317 castings, and an appropriate Edelbrock Performer RPM LS1 intake bolted on top with the same Holley XP 750 carb. Through the same 1⅞-inch long-tube headers and 30 degrees of total ignition timing (through an MSD 6LS ignition), the peak power took the expected hit, softening to 490 hp at a peak of 6,200 rpm.

EQ's replacement 317-casting cylinder head retains the original manufacturer's casting mark near the rocker cover flange, making it easy to spot.

A perennial favorite of LS fans, MSD's 6LS ignition box is simple and effective, easily eliminating most ignition headaches associated with coil-on-plug distribution systems. For carb conversions and EFI engines alike, its programming ease is widely appreciated.

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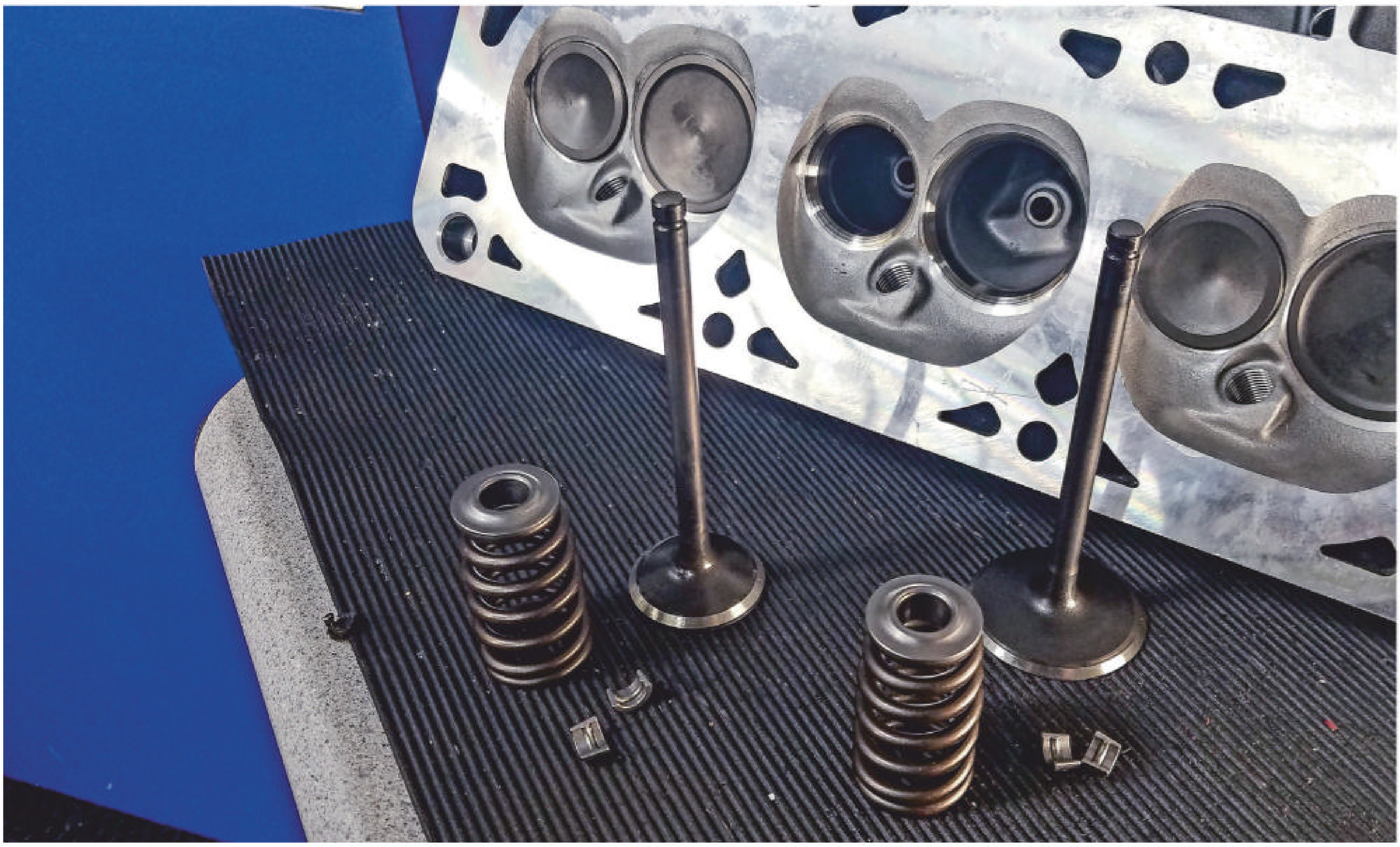
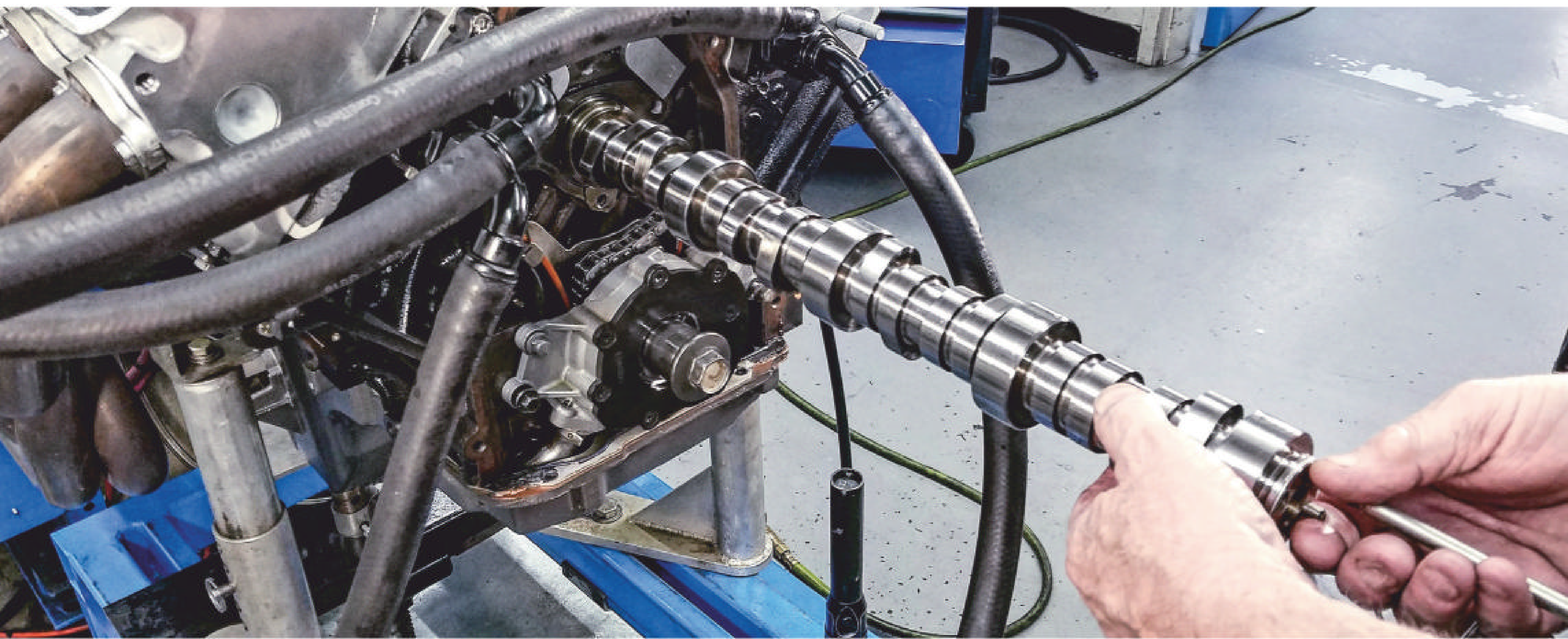


Above: **Shown here with its "swimming-pool" shaped combustion chambers and as-delivered low-lift truck valvesprings, EQ's CH364BA (assembled part number) corresponds to GM's 243 casting and must use a stronger valvespring for an aftermarket cam.**

On its surface, the modest performance doesn't get the 317 head recommended for this particular application, but what is more telling is its performance relative to Gen I and Gen II engines. At 490 hp in unported form on a 364ci V8, the 317 head running pump gas at a 9.5:1 compression ratio would've been an enviable street engine to own 30 years ago. Back then, we'd have been limited in compression ratio to around 9.5:1, but since the LS incorporated improvements to burn efficiency and has a robust tolerance to detonation, it could easily take more squeeze. For that reason, we can go up on the compression ratio without suffering any ill effects, and likely gain much of the lost power relative to the LS3 head. Traditionally, this would involve some machine work, but since we have a set of 243-casting heads ready with smaller combustion chambers, we can cut to the chase!



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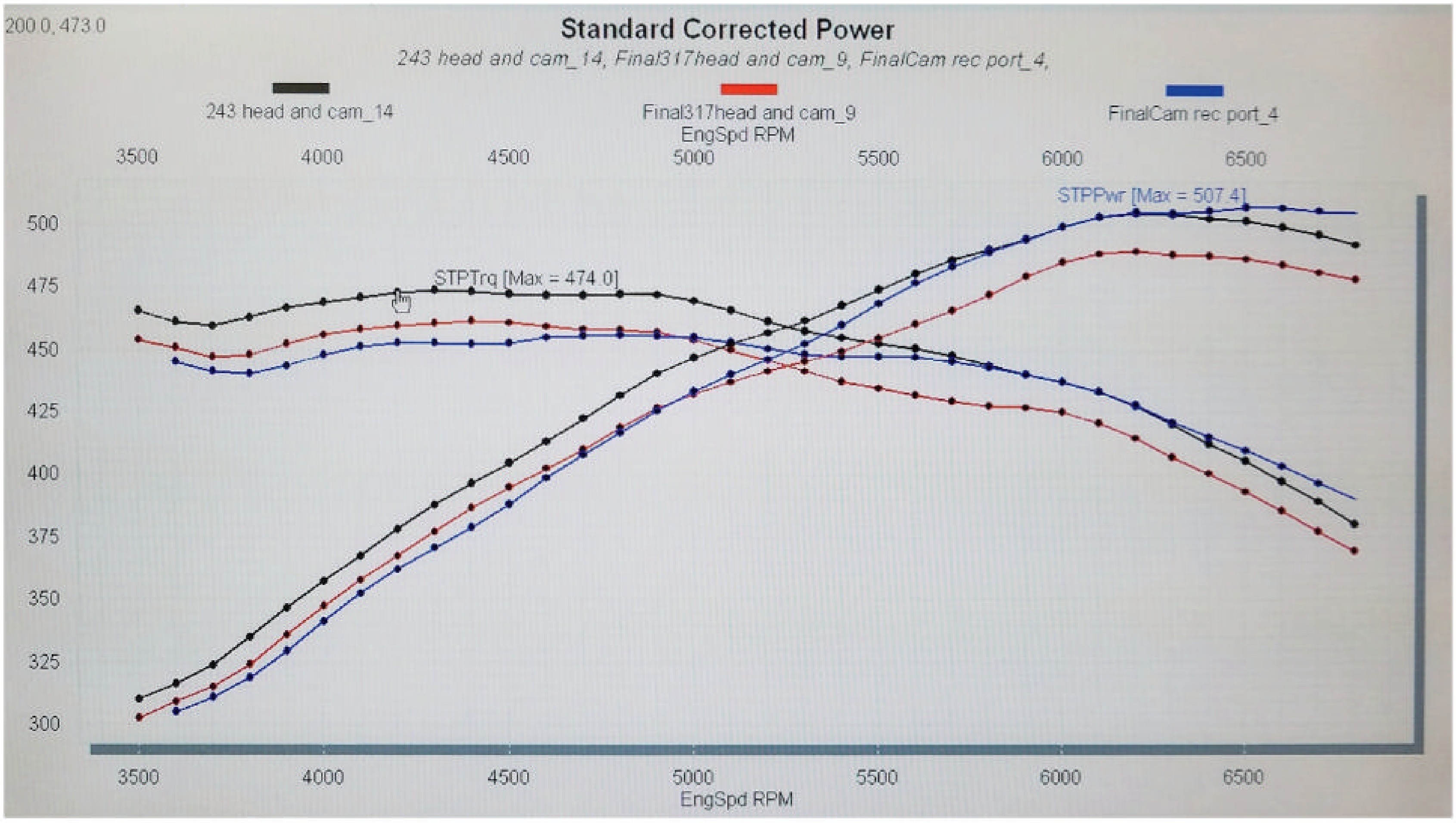
243 Cathedral-Port Casting (CH364B)

At the pinnacle of factory cathedral-port performance is the 243 casting. Originally on the 5.7L LS6 that came in the 2001–2004 Corvette Z06, the 243 was reused on the later 6.0L LS2 in 2005, and also came as an otherwise-identical 799 casting when it was placed atop the 5.3L LM7 truck engine. It seems ironic then that EQ's 243-casting head only comes assembled with the light-duty truck springs, which never got used in 2001–2004 Z06 Corvettes. No matter, we swapped them for the performance-oriented Comp units and bolted our 243 heads on the engine, using the same Edelbrock Performer RPM LS1 intake, MSD 6LS ignition, Holley XP 750, and long-tube headers.

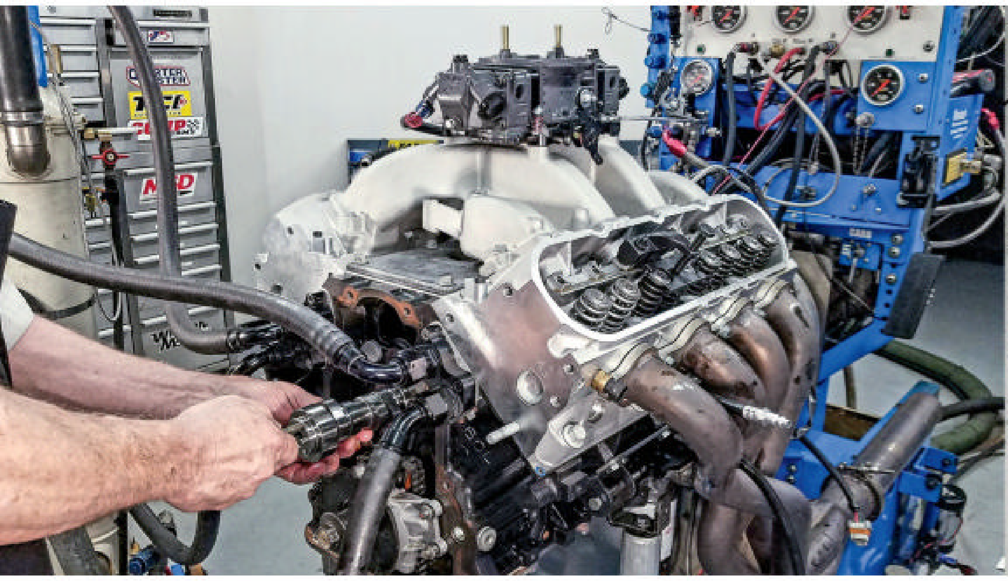


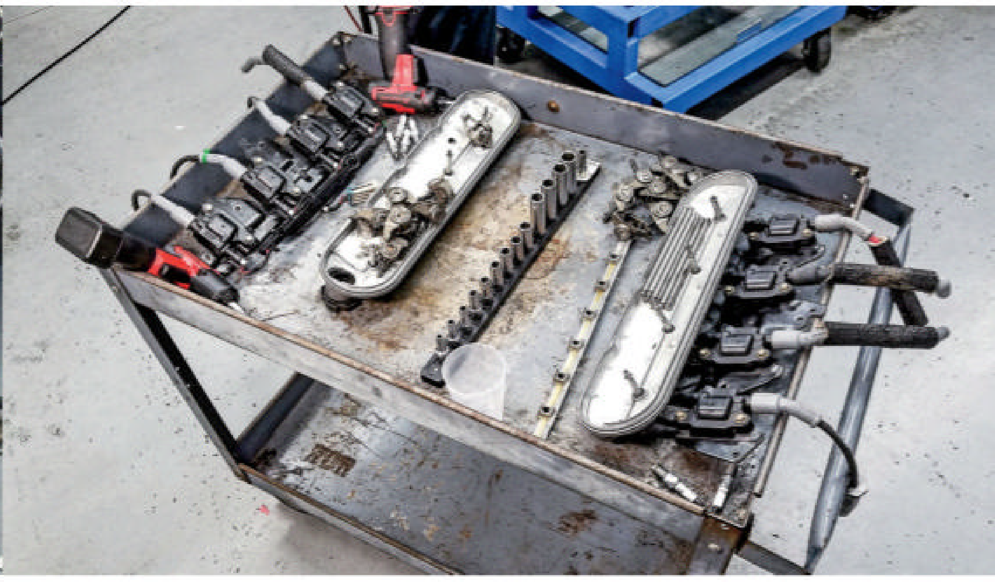
■The final dyno graph shows all three EQ heads on the LY6 as equipped with the Comp Cams LSR camshaft. Blue = LS3 (CH264C), Red = 317 casting (CH364A), Black = 243 casting (CH364C). Note the surprising edge in bottom-end the 317 shows relative to the LS3, even with its lower compression.

A look at the flow numbers for the 317 and 243 heads shows that the flow of the 243 marginally outpaces the 317, a sign we should expect more power from the 243. It's not always a given that the flow volume alone is enough to produce more power. Other factors like mixture motion and swirl come into play qualitatively, as does compression ratio, which with the 243, gained roughly a half a point relative to the 317. That said, the added flow and compression of the 243 heads produced our best overall numbers of the session with a power peak of 505 hp coming in at 6,200 rpm. That's 2 hp shy of the LS3's peak, but when we take a look at what the 243 casting produces down low, it's clear the 243 wins at the stoplight drags any day of the week.

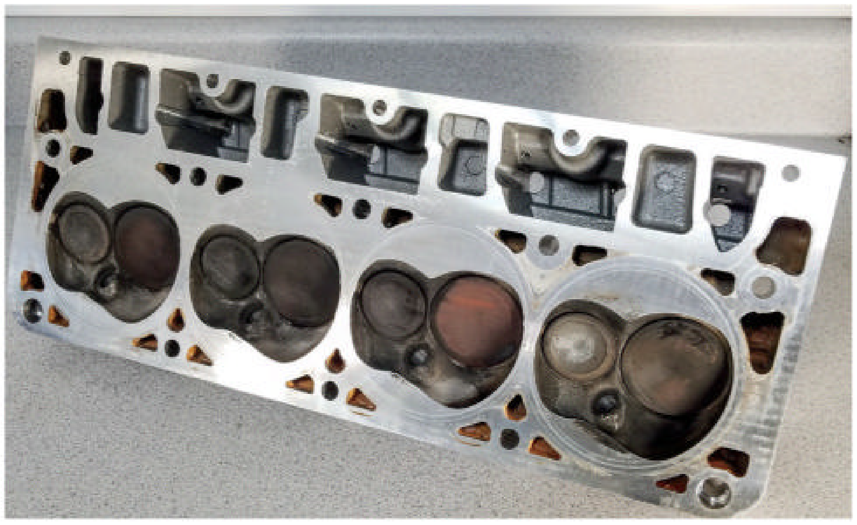
Cylinder Heads Compared

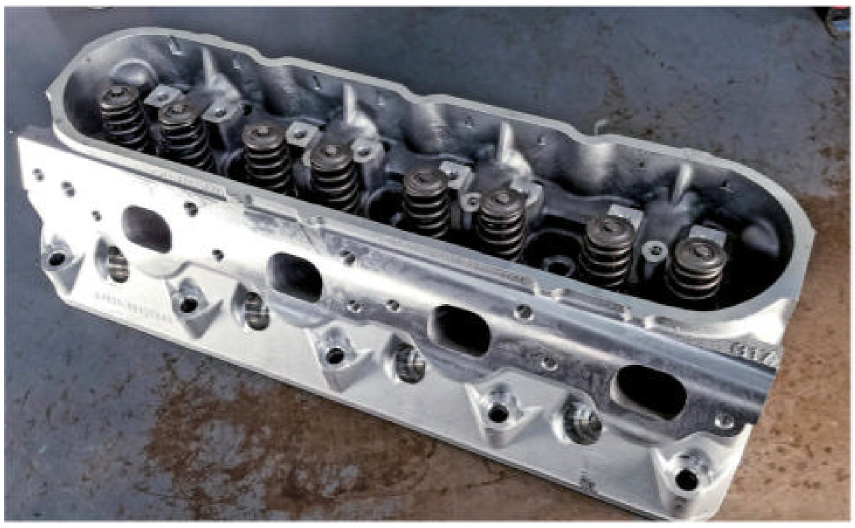
In a comparison of the cammed 243 head and the cammed rectangle-port LS3 head, the LS3 torque peaks at 456 lb-ft at 4,800 rpm, while the 243 head made at least that much torque from 3,500 rpm all the way up to 5,300 rpm, cresting to 474 lb-ft at 4,300 rpm. That's a lot of delicious tire-shredding twist—the kind that makes a street car really fun to drive. Trust us, you won't miss the 2 hp at the top of the curve by foregoing the rectangle-port head. As it applies to a milder, naturally aspirated street engine like our LY6, EQ's 243 casting gets our thumbs up with a fun, fat power curve!





EQ Cylinder Head Specs & Flow Data





LS3 Rectangle Port (CH364C)
Observed Compression Ratio: 9.9:1
Valve Size: Intake 2.165 in, Exhaust 1.59 in
Port Volume: Intake 258cc (+/- 2 cc), Exhaust 87 cc (+/- 2 cc)
Combustion Chamber Volume: 66 cc
Bore Size: 4.00 inFlow Data in CFM

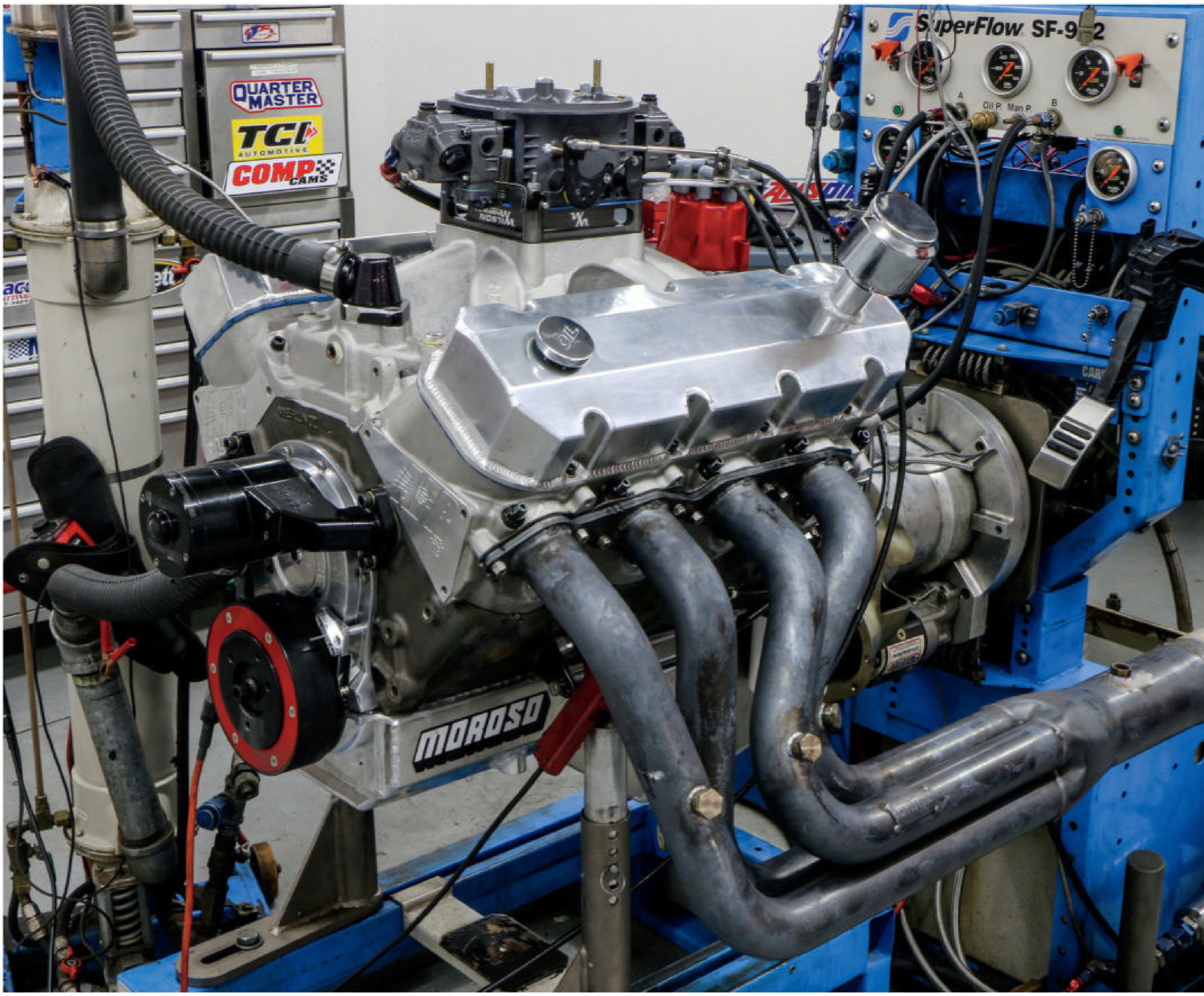
Lift:	In.	Ex.
0.050	33	22
0.100	77	51
0.200	148	95
0.300	211	121
0.400	254	136
0.500	277	149
0.600	294	166
0.700	306	175

317 Casting (CH364A)
Observed Compression Ratio: 9.5:1
Valve Size: Intake 2.00 in, Exhaust 1.55 in
Port Volume: Intake 211 cc (+/- 2cc), Exhaust 76 cc (+/- 2cc)
Combustion Chamber Volume: 70 cc
Bore Size: 4.00 inFlow Data in CFM

Lift	In.	Ex.
0.050	36	26
0.100	63	51
0.200	129	97
0.300	187	126
0.400	229	150
0.500	251	161
0.600	252	168
0.700	251	171

243 Casting (CH364B)
Observed Compression Ratio: 10:1
Valve Size: Intake 2.00 in, Exhaust 1.55 in
Port Volume: Intake 211 cc (+/- 2cc), Exhaust 76 cc (+/- 2cc)
Combustion Chamber Volume: 65cc
Bore Size: 4.00 inFlow Data in CFM

Lift:	In.	Ex.
0.050	37	28
0.100	70	54
0.200	131	100
0.300	189	140
0.400	231	162
0.500	257	172
0.600	268	176
0.700	254	191



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01

Since we were looking for serious power, this 565 featured a ton of good parts, starting with a World Products Merlin III block. The Merlin III featured reinforced bulkheads and main webbing, plus thicker decks to help it withstand elevated power levels. The Merlin III block also allowed us to combine the 4.60-inch bore with a 4.25-inch stroke.

Sources

ARP; 800.826.3045;
www.arp-bolts.com

Comp Cams; 901.795.2400;
www.compcams.com

CP Pistons/Carrillo Rods;
949.567.9000;
www.cp-carrillo.com

Edelbrock; 310.781.2222;
www.edelbrock.com

Holley/Hooker; 270.782.2900;
www.holley.com

K1 Technologies;
www.k1technologies.com

Lucas Oil; www.Lucasoil.com

MSD; 915.857.5200;
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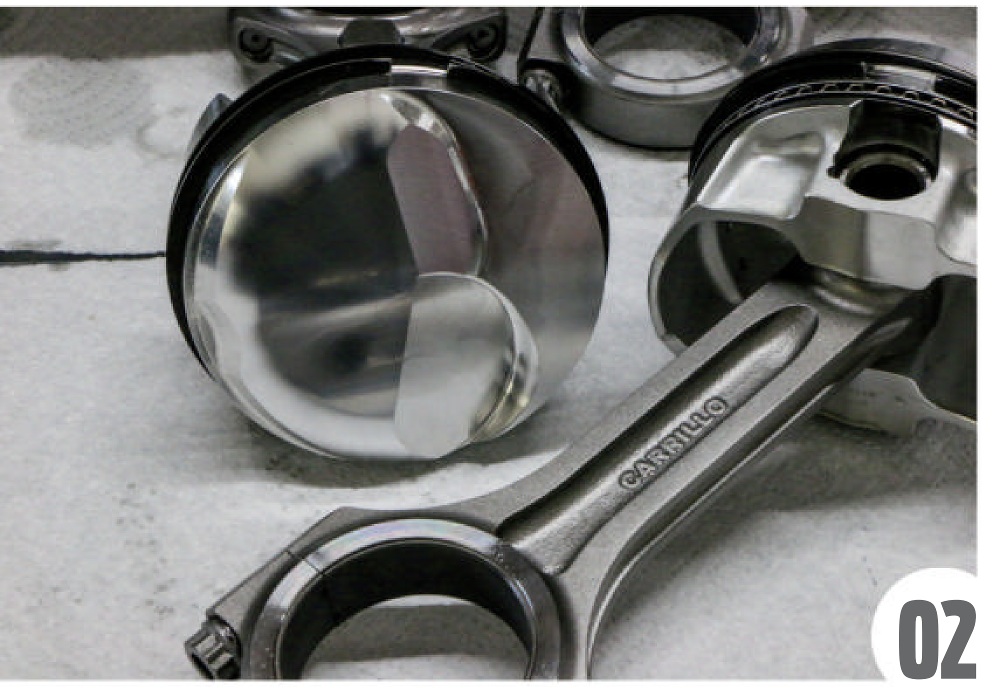

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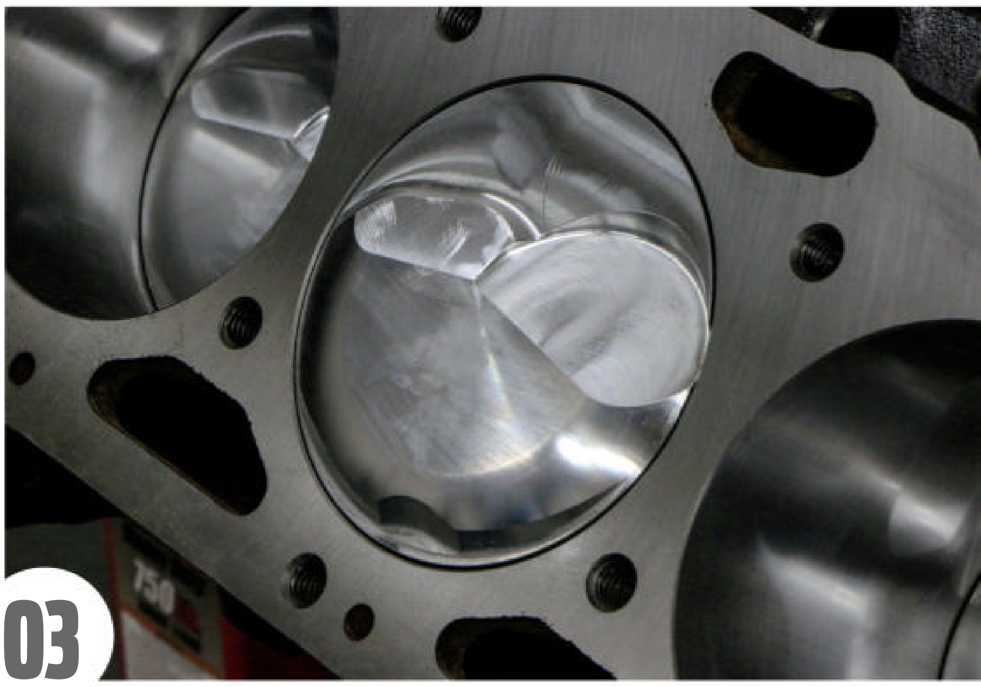

03

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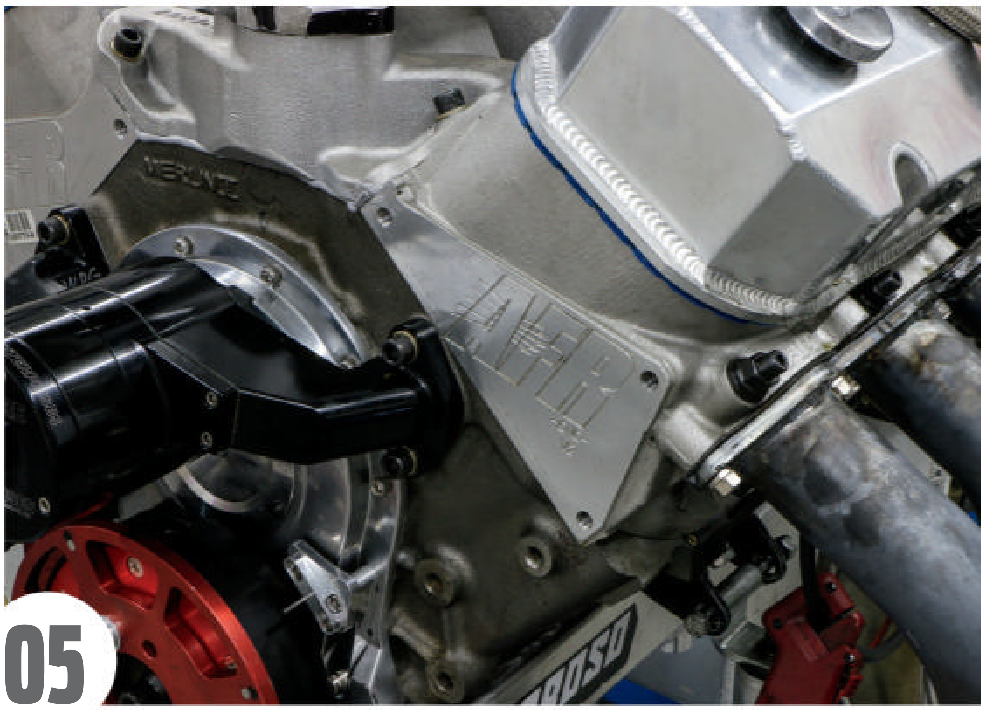

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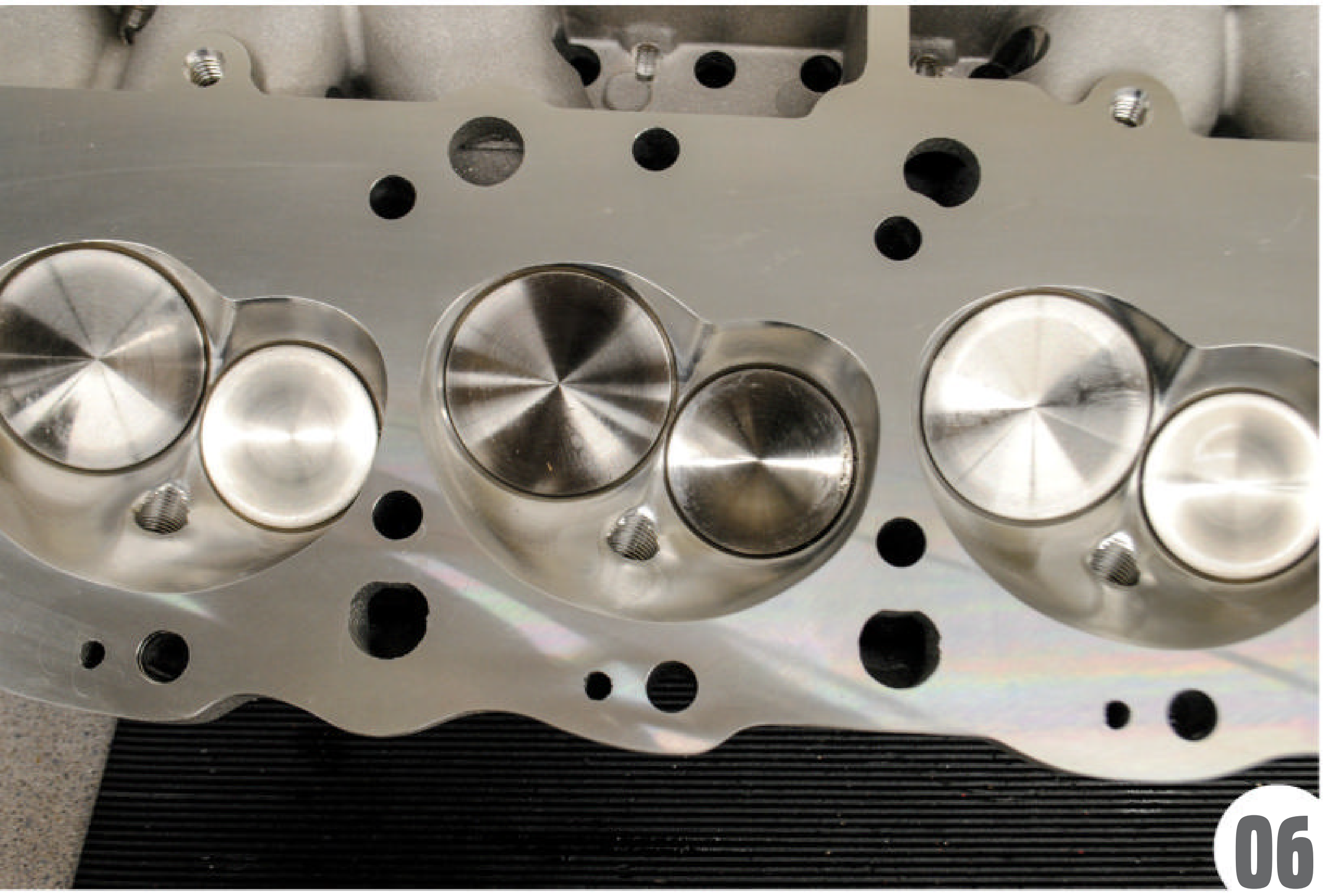


06

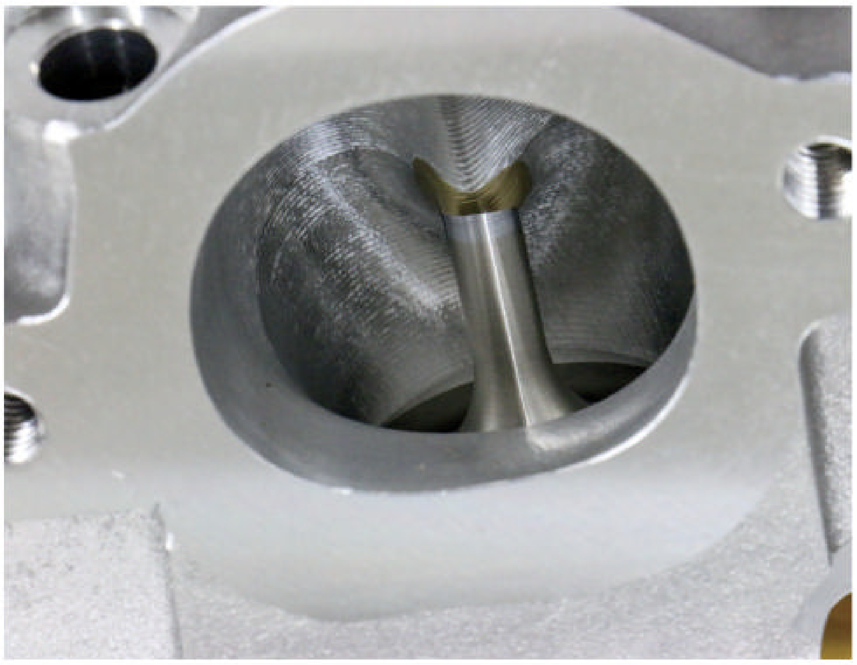
02 To ensure a stout bottom end, we combined a K1 forged crank with Carrillo Bullet-series connecting rods.

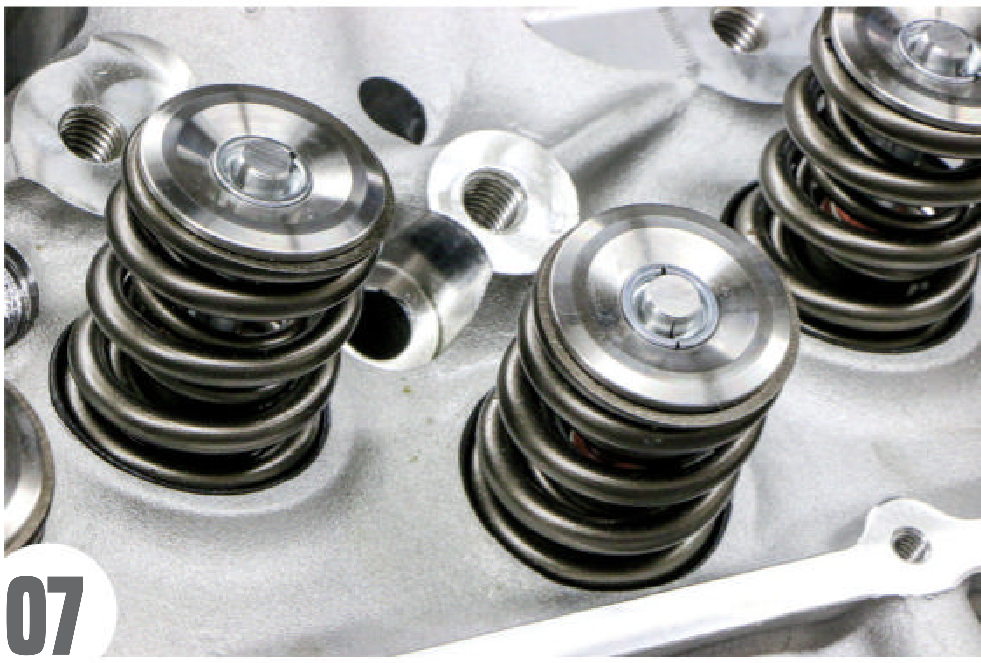
03 Knowing boost and nitrous were also in the cards someday, we installed CP forged pistons designed to provide a static compression ratio of 10.5:1.

04 The cam is a major player in determining the power output of any engine. To ensure our big-block produced the power we were looking for, we installed a healthy roller camshaft from Comp (PN 11-727-9). The solid roller offered 0.800/0.748 lift, 284/300-degree of duration, and a 112-degree LSA.

05 Topping the healthy short block was a set of AFR 357 Magnum heads. The AFR heads were designed for larger-displacement big-blocks running in the higher rpm range like our 565 was set to do.

06 The AFR 357 Magnum heads came complete with 357cc intake ports (flowing over 425 cfm) along with 121cc combustion chambers and a 2.30/1.88-inch valve package.





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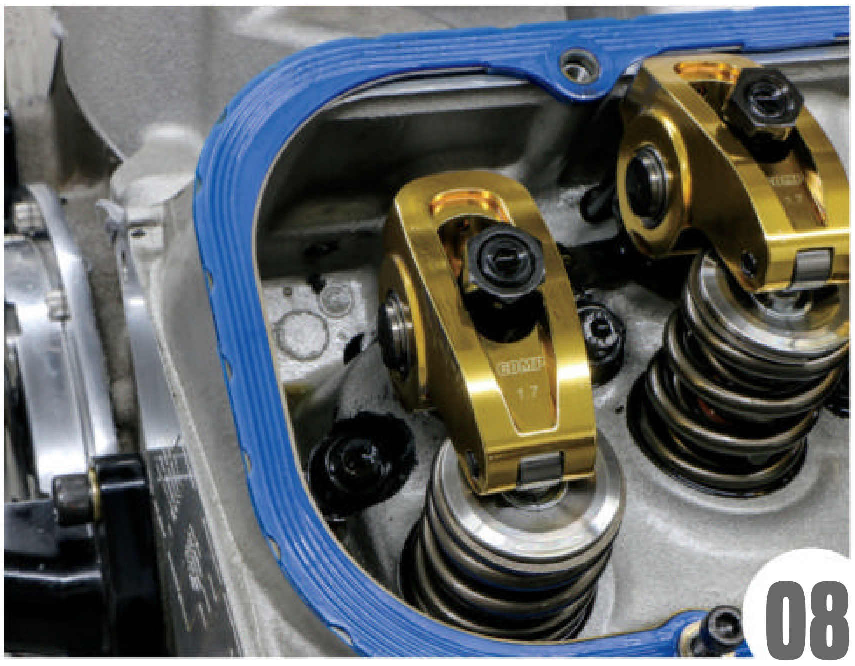

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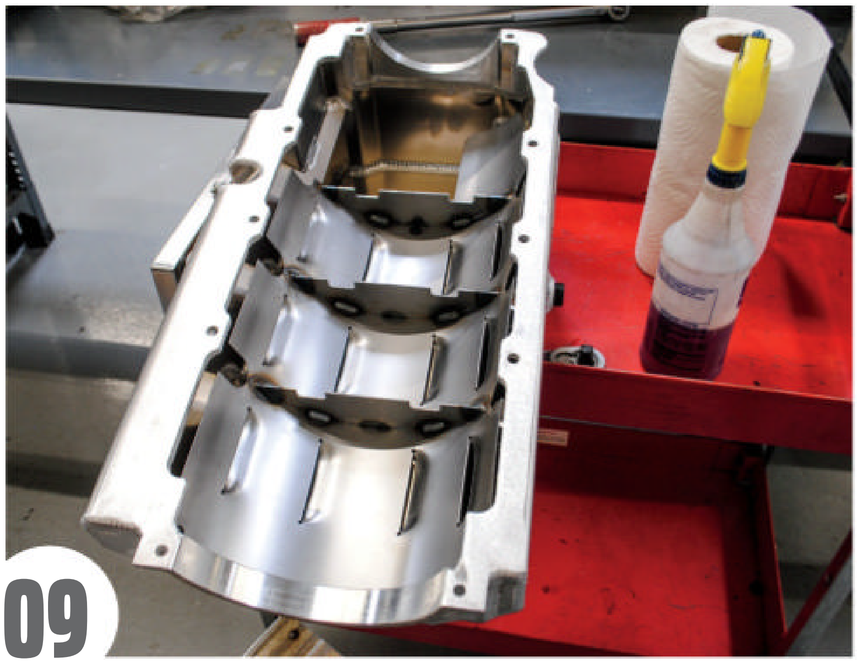

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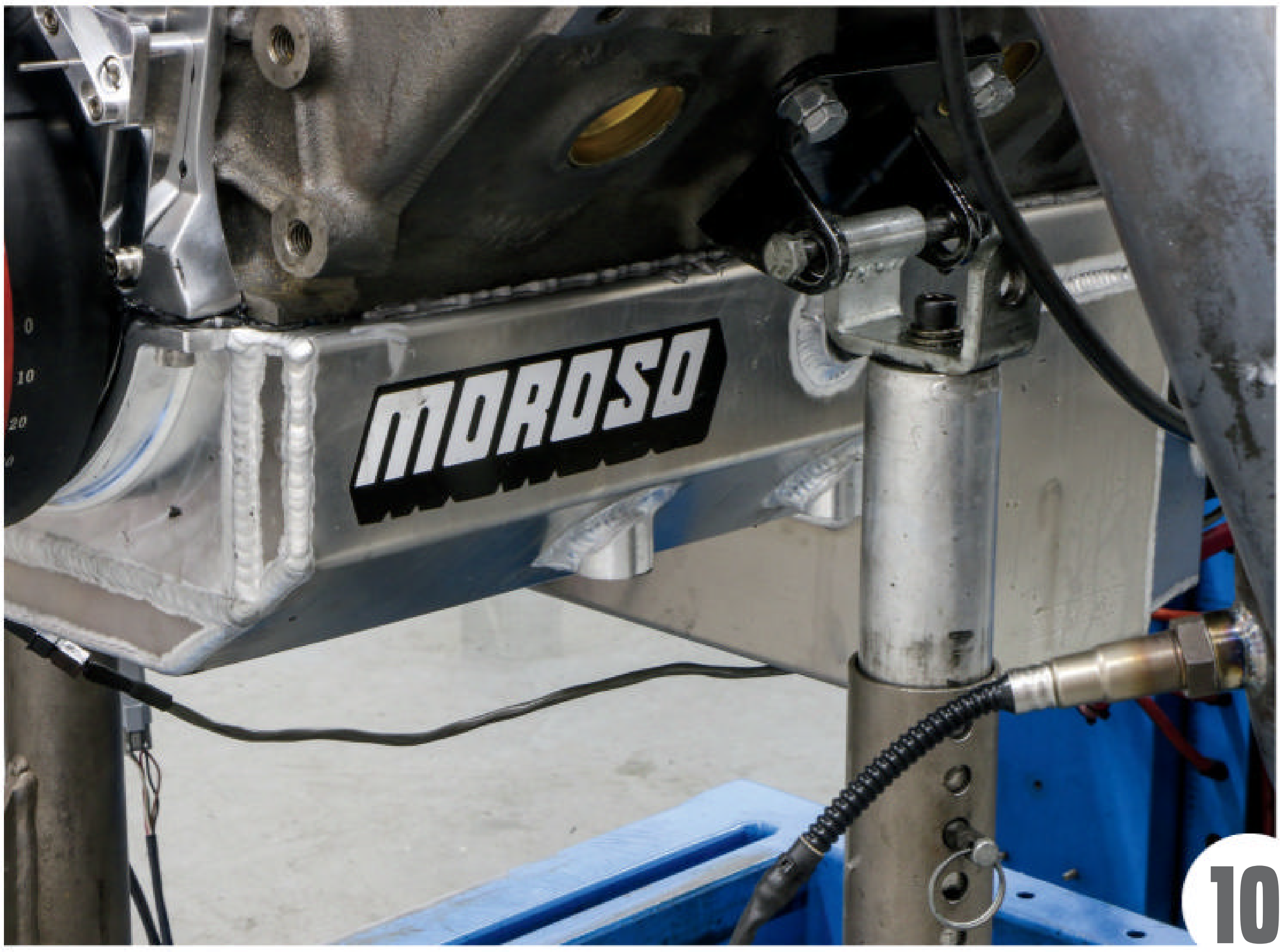

10

07 The heads were supplied with titanium retainers and a set of valvesprings capable of supporting 0.850-inch lift. AFR offers the 357 Magnum heads with other spring packages for milder cam timing, but our 0.800-lift, solid roller required lots of spring pressure.

08 Actuating the valves on our 565 big-block was a set of Comp Ultra-Gold roller rockers. The 1.7:1 aluminum rocker arms featured roller tips, roller trunnions, and 7/16ths mounting studs for use with guide plates. Comp Cams also supplied the .080-wall, hardened pushrods.

09 Big-blocks, especially strokers, suffer from oiling issues. To help cure this, we installed this Moroso oil pan with an integrated windage tray.

10 The fabricated aluminum pan featured internal mounting bolts with O-ring plugs to seal the pan after installation. No leaks is always a good goal to have.

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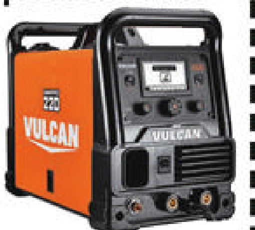

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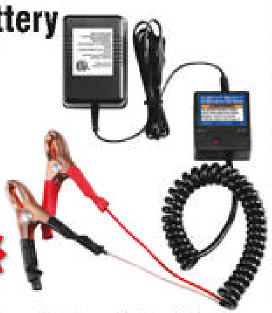

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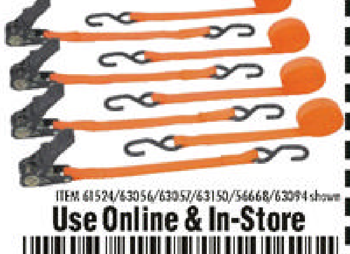

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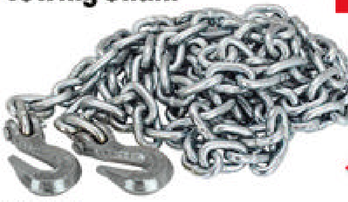

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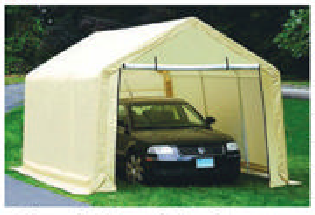

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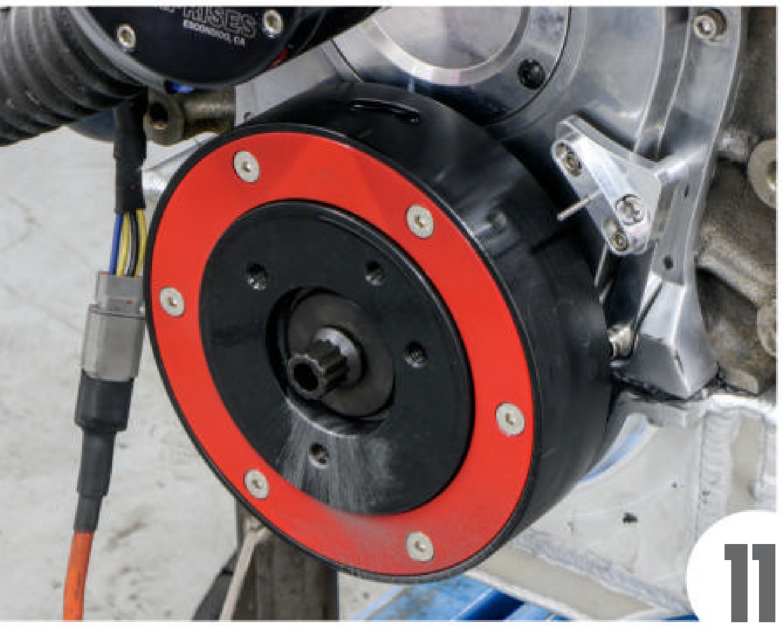

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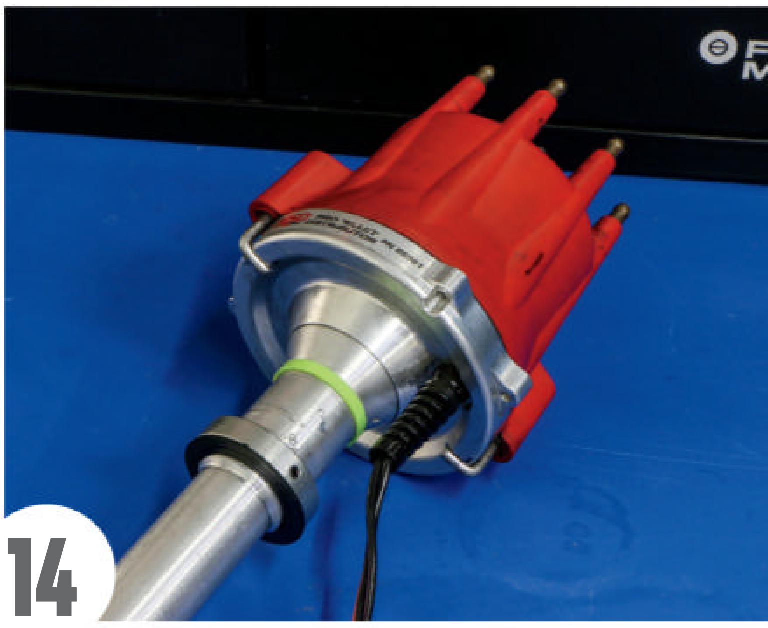


11 The internally balanced stroker required use of this neutral-balanced Speedmaster damper from Summit Racing.

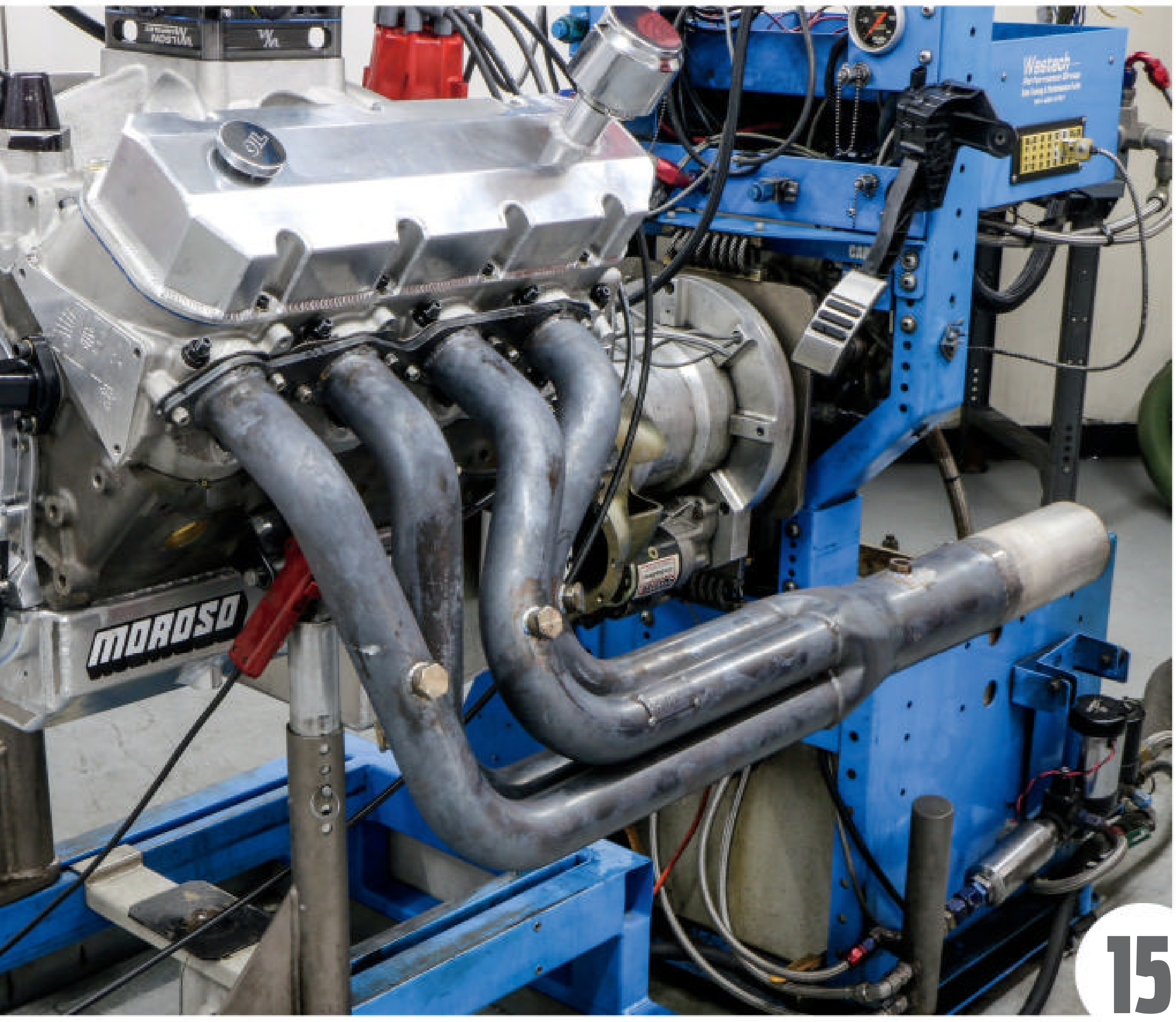
12 A single-plane intake was the natural choice for this high-rpm, 565 stroker, so we selected an Edelbrock Super Victor intake (PN 2927).

13 Mixing the air and fuel for Merlin the 565 was this 1150 Ultra Dominator from Holley. Big engines need big carburetors, and nothing looks more impressive on a BBC stroker than a Dominator, except of course two Dominators!

14 The magic spark for this Merlin came from an MSD billet distributor. We locked the advance in place and installed a bronze distributor gear to work with our solid roller cam core.

15 For dyno use, we relied on a set of 2.25-inch long-tube headers feeding 3.5-inch collector extensions. Nothing fancy here, but these simple headers have proven plenty effective.

16 After the initial break-in and power runs, the first thing we discovered was the timing pointer was off by quite a bit. This engine responded best to a tad over 42 degrees of total (indicated) timing. This took us from a disappointing 760 hp to a more reasonable 822 hp.



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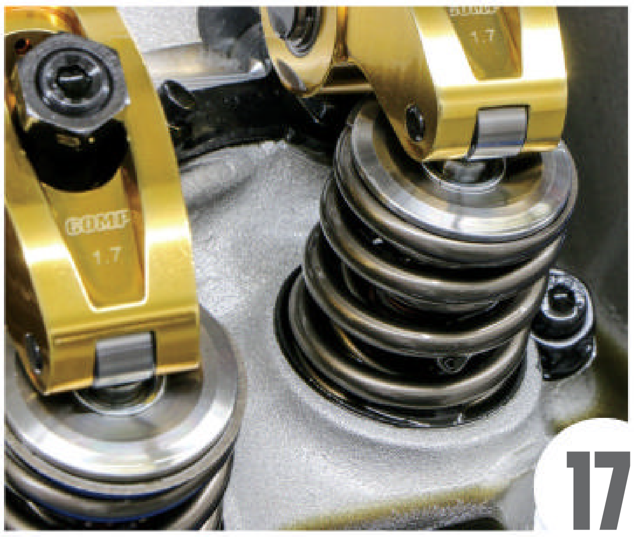

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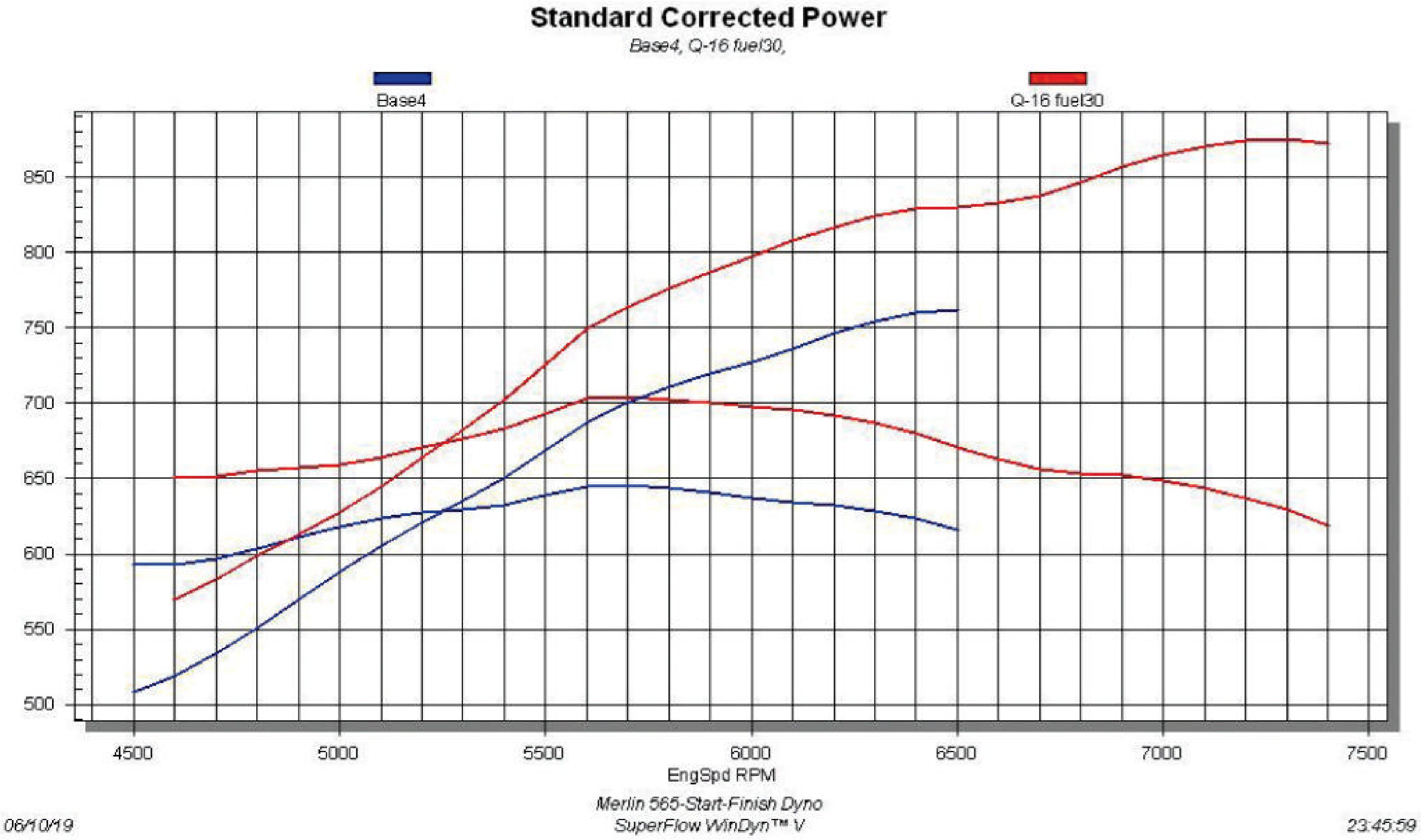
17 Thinking that the cam duration might be a touch excessive on the exhaust side, Westech's Steve Brule backed off the exhaust lash by 0.008, from 0.020 to 0.028 inch. The engine responded by improving the power output to 827 hp. We were inching our way to the 850 mark.

18 After unsuccessful attempts with changes to the oil level, we installed this four-hole carb spacer from Wilson Manifolds. Merlin responded well, as the peak power output shot up to 844 hp. That's a 17-hp gain.

19 Replacing the conventional 30W Lucas break-in oil with a 5W-30 synthetic oil resulted in another jump in power, to 853 hp. Hey, the 9 hp was enough for us to hit our 850-hp goal.

20 The final test involved replacing the 91-octane pump gas with Q16 race fuel. We had hit our 850 goal, so this was more out of curiosity. To keep it fair, no changes were made to timing, but the oxygenated Q16 did require additional jetting.



■Equipped with the Q16, Merlin the 565 BBC eventually thumped out 875 hp and 704 lb-ft of torque! That's a 21-hp gain from the oxygenated Q16! Big-blocks sound great when they are run out to 7,400 rpm!

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Build a Muscle Truck

GM'S POPULAR GMT400 PICKUPS ARE SEEING A SURGE IN AFTERMARKET PERFORMANCE PARTS

As affordable, buildable cars from the '60s and '70s become more difficult to find, we're pleased to see enthusiasts' interests turn to alternative body styles and cars from the '80s and '90s, many of which have just as much, if not more, performance potential as any '60s-era Chevelle or Mustang. One platform that seems to be exploding in popularity is the GMT400, GM's 1988-1998 pickup trucks. Interestingly, these are known colloquially as the OBS Chevys: the "old body style". Speaking as the owner of both a '93 C1500 as well as a '67 C10, I'd consider the 1963-1966 pickups to be the old body style, but what do I know?

John McGann

GMC
California
6S75981

Sources

American Powertrain; 931.646.4836; americanpowertrain.com

Elevated Concepts Inc.; elevatedconceptsinc.com

Gearstar; 330.434.5216; gearstar.com

LMC Truck; 800.562.8782; lmctruck.com

OBS Chevy Racing; 731.989.2256; obschevyracing.com

Pro Performance; 480.420.8175; azproperformance.com

QA1; qa1.net

Ridetech; 812.481.4787; ridetech.com

RockAuto.com; rockauto.com

Common Problems

Overall, these are simple, reliable trucks, but like all vehicles, they have quirks you'll likely need to address as an owner. Here are a few, in no particular order:

Rust!
Yes, that disgusting tin worm that destroys our precious vehicles has a voracious appetite for these pickups. Though touted at the time as having excellent corrosion protection, that statement was only true in reference to this generation's predecessor. Cab corners, rocker panels, and the wheel arches are especially susceptible to rot, particularly in wet and snowy climates.

Crappy Plastics
GM redesigned the dashboard in these vehicles for the 1995 model year, and that was a significant improvement over the hard plastics used for the early dashboard. Those are prone to cracking or disintegrating completely due to sun damage, while the later design was much more resistant. The cloth upholstery also fared better than the leather seats over time.

Vanishing Clearcoat
Typical of most American cars in the '80s and '90s, the paint is easily damaged by the sun, and you'll likely find oxidized clear coat, if the clear hasn't all peeled off by now. This is more of a materials issue, as the American manufacturers attempted to comply with new paint-emissions regulations.

The Brakes are too Damn Small.
C1500s came with 11x1- or 1.25-inch front rotors with single piston calipers, and either 10- or 11-inch drums in the rear. Speaking from experience, if you do any towing, hauling, or spirited driving, you'll be wishing for bigger brakes up front at the very least. Plus, the Quick Take-Up brake master cylinder and low-drag brake calipers, while sounding good on paper, combine for a mushy feel and long pedal travel that isn't inspiring.

On the whole, those aren't major problems, and solutions to all of them are easily found in the aftermarket. These trucks were prodigious and popular enough that many original replacement parts can be found at dealership parts counters, online retailers like RockAuto.com, and at your local auto parts store. You can also find plenty of good, used parts in the junkyards, which is a huge plus. Replacement sheet metal is available from restoration companies like Classic Industries, and truck specialist LMC Truck. You can buy the aforementioned cab corners and rocker panels, as well as complete doors, bedsides, floors, fenders, hoods, and tailgates, and all are surprisingly affordable, too. Door panels, carpet kits, and new upholstery are widely available, allowing you to spruce up that tired interior with a quick weekend's work.

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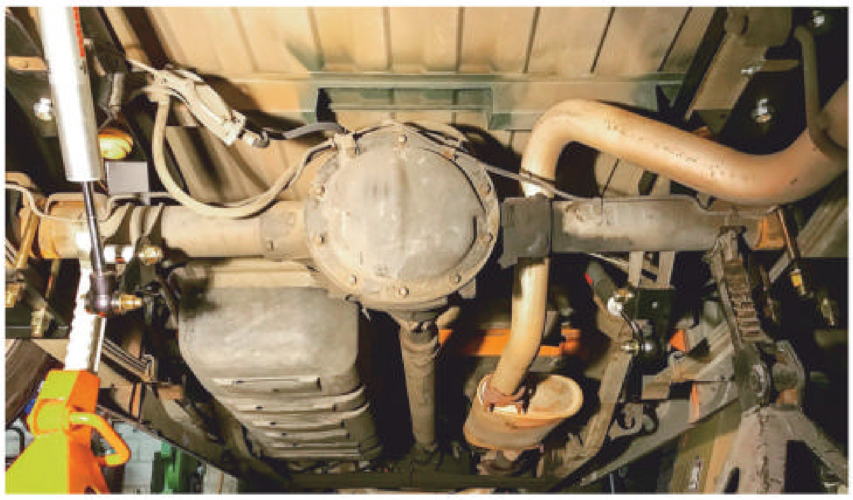
Anyway, the OBS label was assigned to the GMT400 once the GMT800 (model years 1999-2006) was introduced, and that generation is known as NBS, or "new body style". It should also be said here that, in SUV form (Tahoe, Yukon and Suburban), the GMT400 continued through the 2000 model year, and even into 2002 for the one-ton C3500 pickups.



Outwardly, the GMT400 was quite a visual departure from the square body trucks it replaced, but more noteworthy changes could be found underneath its sleek, aerodynamic body. This was the first GM pickup to have an independent front suspension on their 4x4 models, with torsion bars and CV joints replacing the solid front axle and leaf springs of the previous generation. Another innovation introduced on the GMT400 was shift-on-the-fly four-wheel drive, which replaced the previous generation's manually-locking hubs. The frame was widened to move the fuel tank inboard, quelling safety concerns about the older truck's sidesaddle gas tanks.

The GMT400's clean, rugged looks have stood the test of time, and its relatively simple construction lends itself easily to modifications. With literally millions built over its production run, these trucks are affordable and waiting to be restored or restomodded with an increasingly growing number of performance aftermarket parts.

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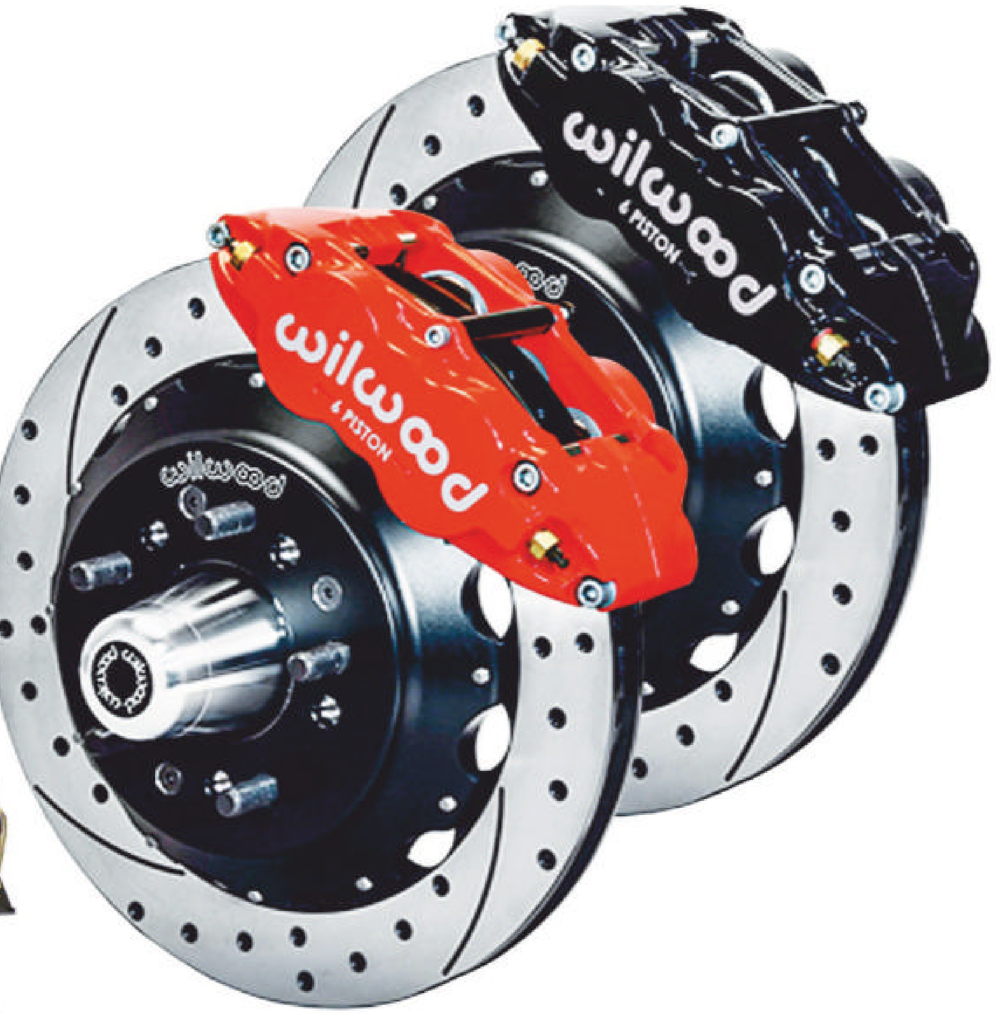
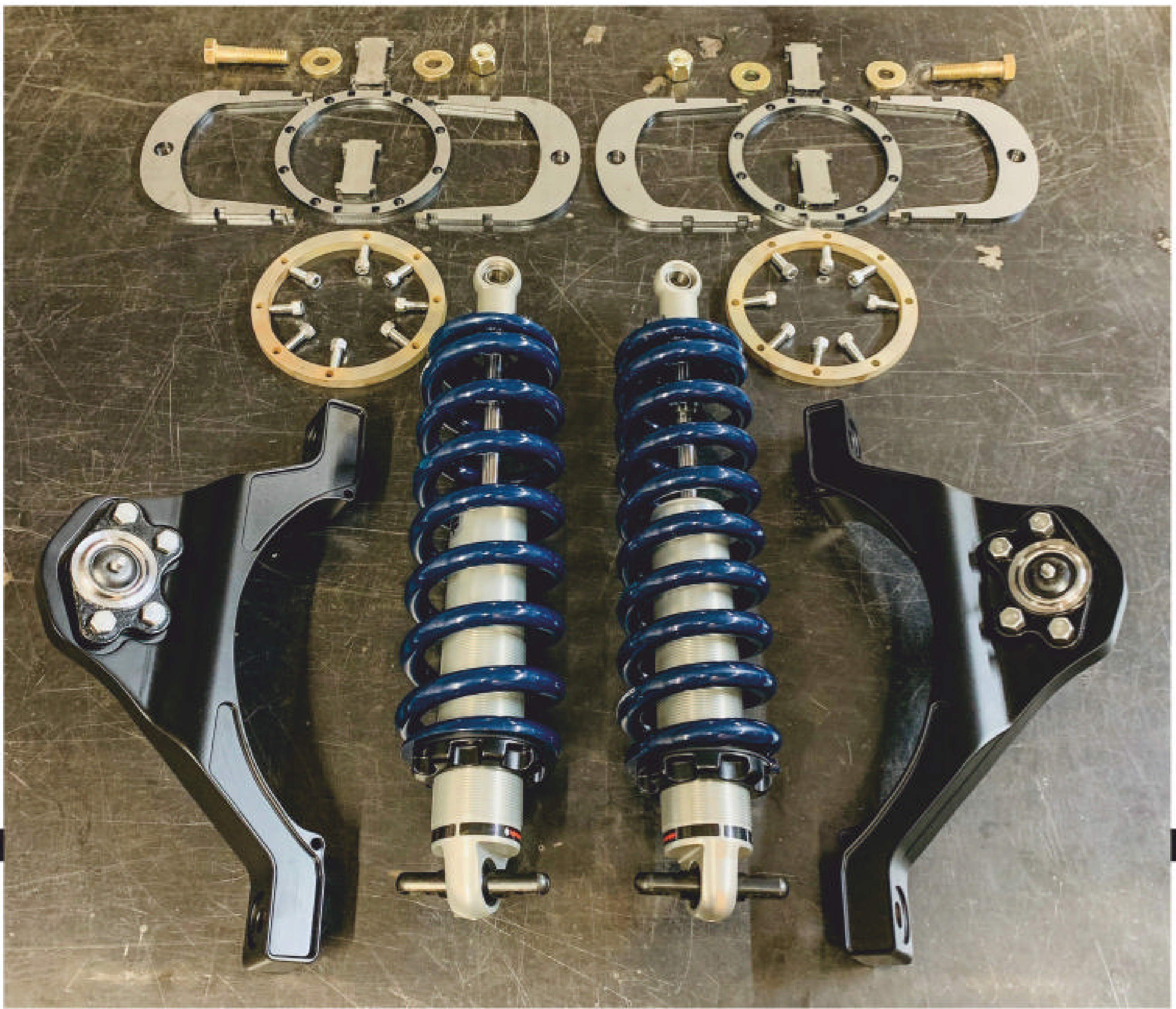
Performance Parts

If you're looking to build a performance-minded muscle truck, there's never been a better time. Check out RedX, the 1990 C1500 built by OBS Chevy Racing's owner Arnie Gonzales. An unlikely track-day warrior, Arnie says he and this pickup gives many unsuspecting sports car owners a spanking at track events across the Midwest, and it gets the job done with coilovers up front and a Panhard bar and track bar combination supporting the stock leaf springs. There's nothing exotic about the drivetrain, either. Under the hood is a 5.3L from a late-model Silverado and a T56 six-speed manual transmission.

In the braking department, Little Shop Mfg offers 14-inch and even 16-inch disc brake upgrades utilizing a combination of Wilwood components and their hubs and brackets, which are manufactured in-house. Truck specialist Pro Performance offers several brake kits, too, plus suspension upgrades to fit your budget, and a comprehensive list of LS engine swap parts.

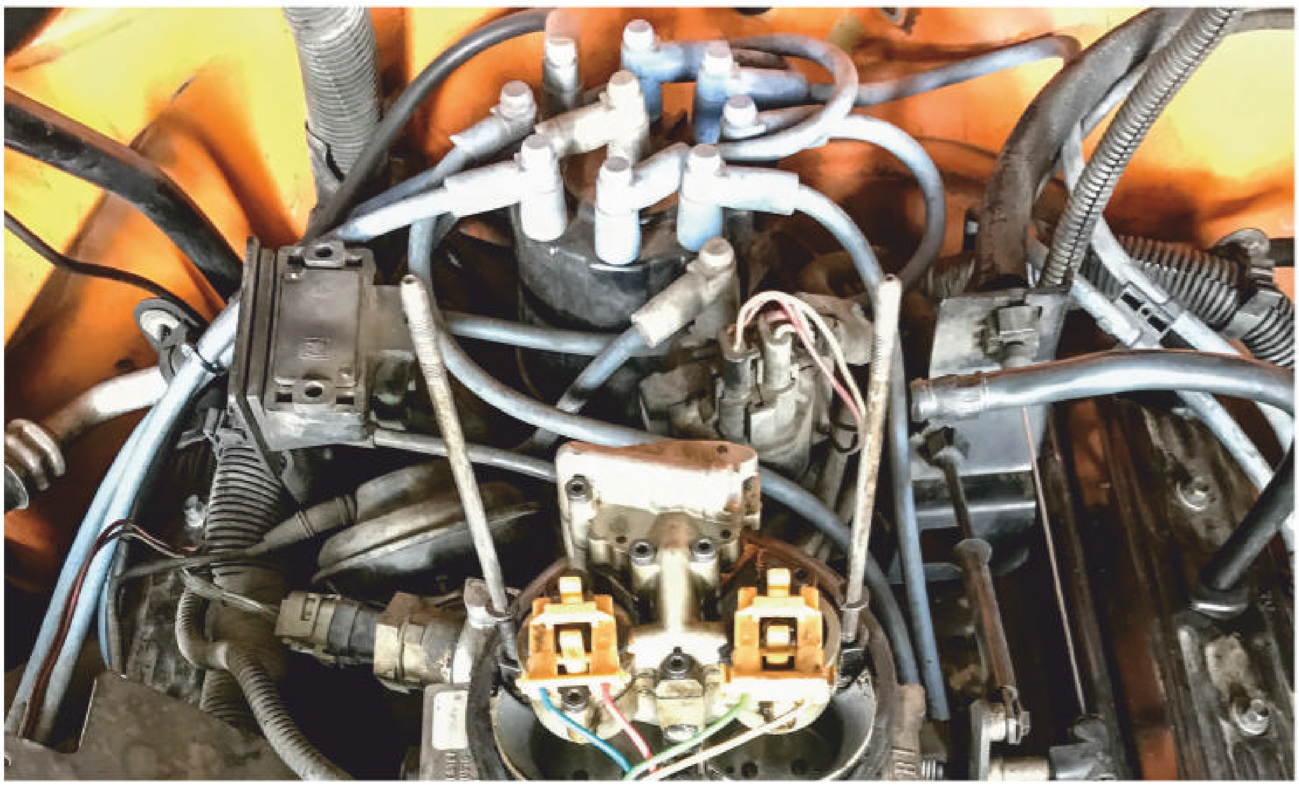


Ridetech and QA1 recently introduced front and rear coilover conversion suspension kits, if you're wanting to step up from the typical drop spindle and axle flip lowering kits. Ridetech's kit utilizes a unique rear upper A-arm to locate the axle housing, while QA1 opts for a proven torque arm and Panhard bar out back.



Tubular front A-arms and bigger sway bars are available from several manufacturers, with adjustable shocks to dial-in the ride. For cottage-industry options, check out the suspension and frame stiffening system from Elevated Concepts. Owner Derek Parker is a GMT400 fanatic and developed a company solely devoted to suspension and rack-and-pinion steering systems for the platform. OBS Chevy Racing offers billet upper A-arms that allows easy camber and castor changes at the track. The company also developed a front coilover conversion, frame stiffening bars and boxing plates, and a Panhard and track-bar kit that improves the performance of the rear leaf spring suspension.

Drivetrain Diatribe

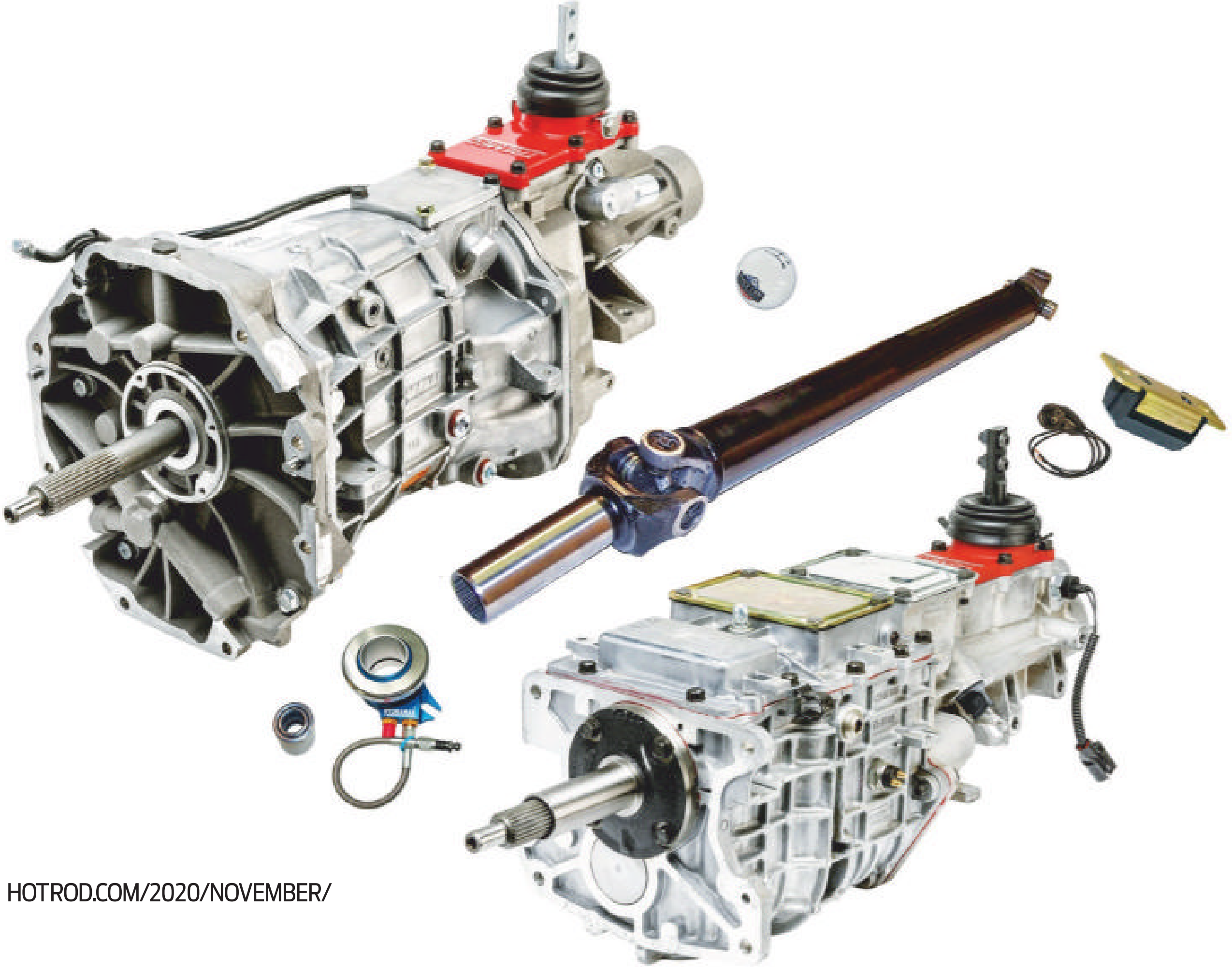


Things can get problematic when considering engine performance upgrades, depending on your local emissions laws. Obviously, the sky's the limit if you live somewhere that doesn't require emissions tests, and things aren't so bad if you live somewhere that only does tailpipe testing. It gets ugly in a place like California that has strict visual and rolling tailpipe emissions tests because there aren't very many options for this era's throttle-body injected (TBI) engines, or the 1996 and later Vortec 350. CARB-compliant cylinder heads and camshafts are available, as are compliant headers, but tuning these OBD-1 and early OBD-II vehicles is more difficult and typically requires new PROM chips to be burned and then installed into the ECM/PCM. Flash-programmable EEPROM conversions and tuning software for OBD-1 computers are available, however. Check out Moates.net and GearHead EFI for more information.

It's shortsighted for places like California to be so restrictive with what modifications are allowed. With today's aftermarket performance parts, it's entirely possible to build a cleaner running, more powerful, more fuel-efficient small-block Chevy to replace the outdated TBI system and it's accompanying electronics. Things aren't any easier for folks looking to install a newer 4.8, 5.3, or any other LS1 variant. Though these engines are definitely cleaner running, with sequential port fuel injection and precise engine management systems, to be CARB-approved, every single component of the donor chassis needs to be in place, from the smallest hose in the EVAP system, to the manifolds and catalytic converters, which may or may not fit GMT400's frame. You'll also need to prove that the ECM is unmodified and contains the factory programming. Personally, I'm happy to comply with tailpipe emissions; I like clean air, but I wish California would ease up on the bureaucratic-minded visual inspection restrictions, and pedantic engine-swap guidelines. Technology has moved on.

Fortunately, transmission upgrades are simpler to accomplish. These trucks came with 4L60 or 4L80 transmissions, which became electronically controlled sometime around 1993. Plenty of aftermarket options are available. Gearstar can build a virtually bulletproof unit designed for all-out performance or hard work, if you're hauling stuff around.

If equipped with a manual, a few different versions appeared during the production of these trucks. The half-ton pickups typically got a HM290/5LM60 or NV3550 five speed, which were generally rated to handle somewhere around 300 lb-ft of torque. The 2500 and 3500 series trucks could be had with a more robust NV4500. These transmissions were specific to the trucks and not shared with passenger cars, and are geared accordingly with a steeper first gear and bigger RPM drops between gear changes.



If you are looking to ditch the automatic for a manual in a performance application, you'll be better off installing a "car" transmission, rather than either of the New Venture units mentioned above. American Powertrain has a GMT400 kit that will hook you up with a TKO five-speed or a T56 Magnum six-speed, depending on your power level and budget. They've also got the flywheel; clutch assembly; hydraulics; and can help you find a clutch pedal, since used ones tend not to show up on eBay too often—at least in our experience. These smoother-shifting Tremec transmissions will transform the truck's driving experience.

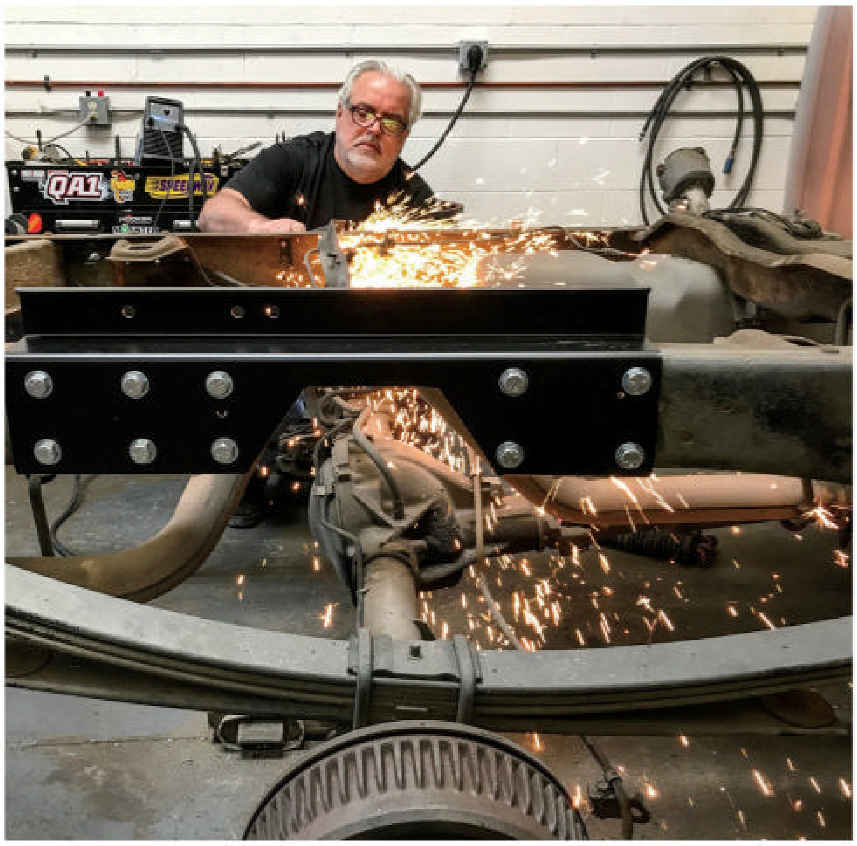
Project Jake

Most readers recognize this 1993 GMC Sierra C1500 single cab shortbed pickup. A former Caltrans truck, Jeff Smith bought it at a government auction—actually he and friend Tim Moore each bought Caltrans trucks one day in 2004. They dubbed the pair Jake and Elwood and both proceeded to build them as magazine project vehicles. Jeff's build, Jake, appeared in three issues of *Car Craft,* while Tim's build, Elwood, was for *Chevy High Performance.* Each build was slightly different in scope, but both were a budget-oriented makeover with some performance parts; "blue collar bruisers," as Jeff described them. Jeff's truck had 204,000 miles on it when he bought it, though it was on its recently-installed second engine. He gave the truck a cosmetic makeover with a cowl-induction hood, an Earl Scheib paint job, a 2/4-inch suspension drop, and 17-inch aluminum Rally wheels, then added CARB-legal shorty headers, and a performance exhaust system, some TBI modifications, and a chip change from Hypertech, and had the 4L60 rebuilt.

In all, Jeff coaxed 168 hp and 229 lb-ft of torque to the rear wheels for his efforts—not great, but roughly where it should be for a mostly-stock TBI 350, which was rated at 210 hp and 300 lb-ft at the flywheel. By contrast, the more efficient Vortec 350 (1996 and later) made 255 hp and 330 lb-ft. After the work documented in those three *Car Craft* articles, Jeff drove the truck to work every day for 11 years, adding another 150,000 miles to it.

I bought Project Jake from Jeff in July 2017. Since then, I've replaced the power steering hoses; steering gearbox and linkage; the front brakes; the A/C compressor; a leaking rear-wheel cylinder; both lower ball joints; an upper A-arm bushing and the distributor, which developed an intermittent RPM signal. I've also done the obligatory tune up and fluid changes. None of that work is out of the ordinary, nor was it expensive. I picked up a replacement tailgate and a pretty good dashboard from the junkyard, both of which were cheap, too.

Next, *HOT ROD Garage* co-host Lucky Costa and I installed a Ridetech 4/6 suspension drop kit with single adjustable shocks, and I recently rebuilt the door hinges, installed new door weatherstripping, and replaced several broken lock rod and door-handle clips. Jake has been my daily driver since the day I bought it.



The odometer currently shows 391,800 miles, and the car has been drop-dead reliable and inexpensive to operate, well aside from the nearly weekly $75 (or more!) fill ups at the gas station. That is more of a function of our crappy Los Angeles traffic, however. The best fuel economy I saw was 21 mpg in open freeway driving returning from Bonneville last year.

In truth, the GMT400 platform has been desirable since the day it came out, with customizers like Boyd Coddington being among the first to modify them. It's not quite accurate to say the GMT400 platform is the next big thing, when it really always has been popular, but in the last two years, we've seen a dramatic uptick in the amount and quality of performance aftermarket parts available for this platform. It will be very interesting to see how far it goes.

Actor, podcaster, and new *Top Gear America* co-host Dax Shepherd owns this pristine 1990 454 SS, one of just under 17,000 made between 1990 and 1993. Dax recently picked up this low mileage example, showing just 28,000 miles on the odometer. The 454 SS was the only way you could get a big-block in a half-ton pickup. The TBI 454 made between 235 to 255 hp and 385 to 405 lb-ft of torque, depending on the model year. Though they were only in production for three years, they have become increasingly sought after. Dax's pickup is at *HOT ROD Garage* co-host Lucky Costa's shop for some interesting modifications.

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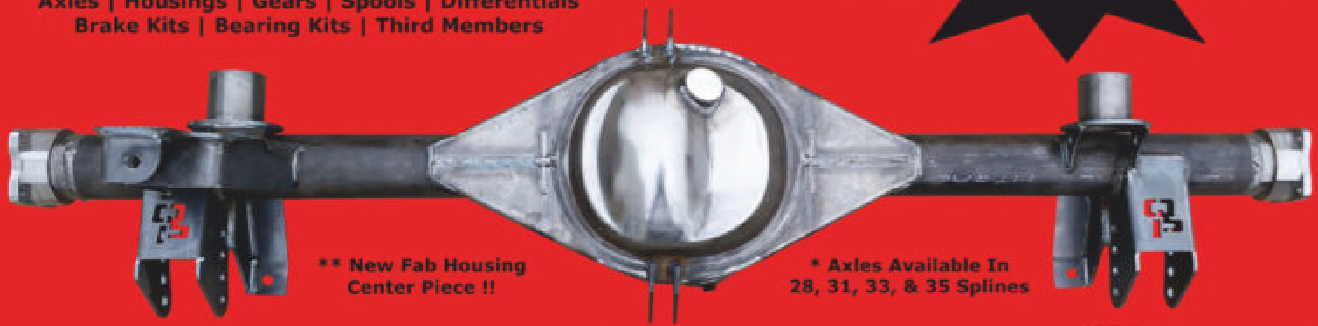

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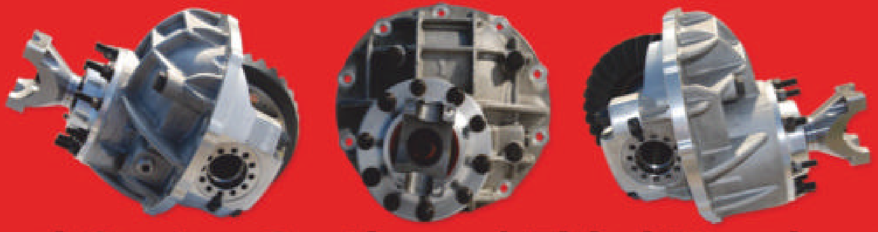

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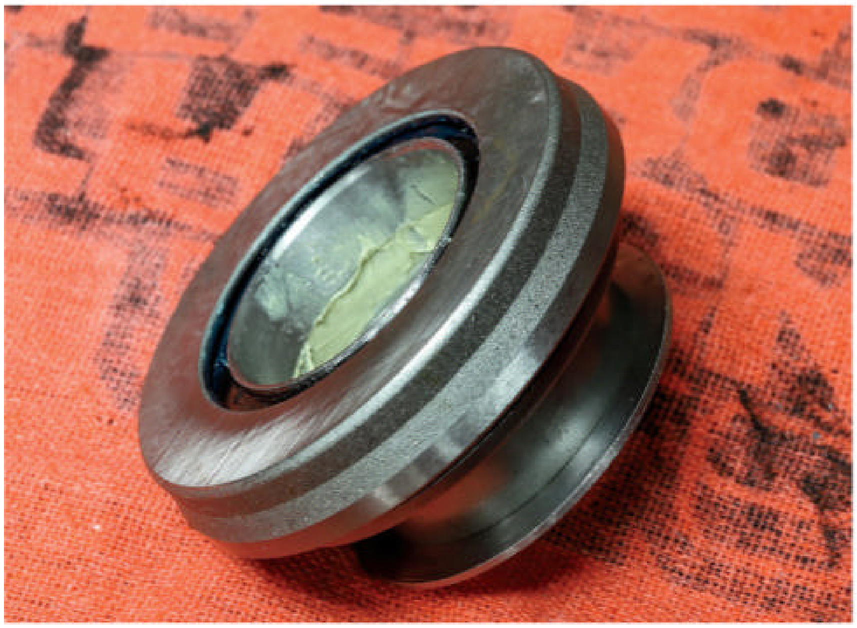
What's a Throwout Bearing? We Tell You Here!

John McGann

HOT ROD Explains What a Throwout Bearing is and How it Works

Technically speaking, the correct terminology is release bearing, as in clutch release bearing. When considered in those terms, it's easier to imagine what this component is and what it does. The throwout bearing is the last piece in the series of components that comprises the clutch linkage, from the pedal to the clutch assembly, inside the transmission bellhousing. It is a bearing, meaning that it allows interaction between a moving surface and a stationary surface. Just like wheel bearings allow movement of the spinning wheel hub around the non-moving spindle, the throwout bearing is the component that comes between the clutch pressure plate, which is spinning when the engine is running, and the non-moving clutch fork—or the hydraulic slave cylinder typically found in newer cars. Though there are a few different ways a clutch can be actuated, mechanical or hydraulic, the function of the throwout bearing is the same. It connects moving and non-moving parts.



The throwout bearing is made up of a base, which is attached to the linkage assembly, the outer shell that pushes against the pressure plate, and the bearing assembly located between the two.

01 In a clutch assembly, the pressure plate is bolted to the flywheel and is rotating whenever the engine is running. The friction disc slips over the splines of the transmission's input shaft and only turns when the drive wheels are turning.

02 The release bearing is held by the stationary clutch fork and, when the clutch pedal is pressed, pivots forward to contact the diaphragm spring of the pressure plate, which act like a lever to disengage the clutch, separating the mechanical link between the engine and the transmission's input shaft. Clutch linkages are either mechanical or hydraulic. Hydraulic clutch systems will have either an external slave cylinder or an internal slave cylinder. Mechanical systems include actuating rods and a bellcrank, commonly referred to as a Z-bar, or via a cable between the pedal and clutch fork.

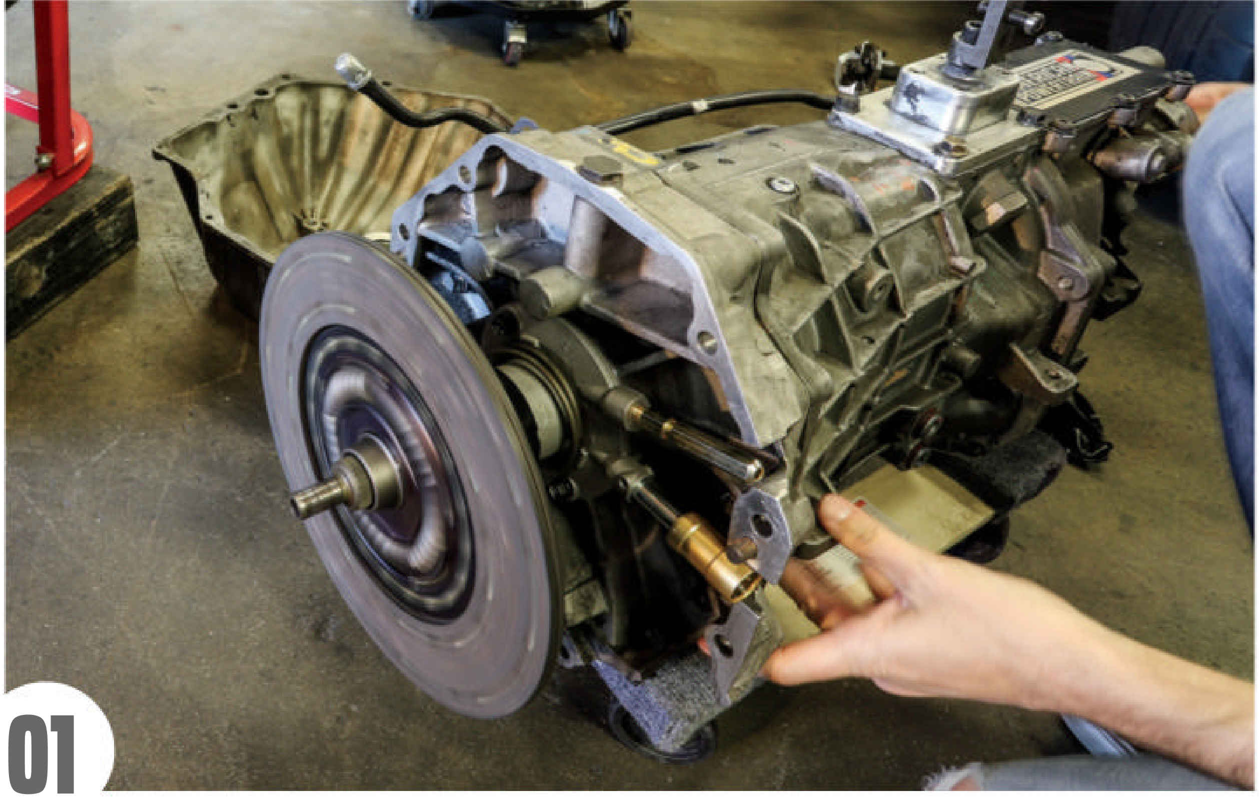
03 Most cars made since the late '90s have hydraulic clutch systems with an internal slave cylinder, meaning the slave cylinder is located inside the transmission bellhousing.

04 The slave cylinder is housed within the base of the bearing assembly. When you press the clutch pedal, fluid from the clutch master cylinder is forced through hydraulic lines into the base and to a piston below the bearing assembly, which forces the bearing surface to push the diaphragm springs of the pressure plate. In this photo, the long tube is the bleeder fitting, the fluid inlet port is located below it.

05 The bearing surface of many Internal slave cylinders is designed to maintain contact with the pressure plate—its outer surface is always spinning—whether the clutch is engaged or disengaged. It is self-adjusting, meaning that the spring between the bearing and base puts tension on the bearing, keeping it in contact with the pressure plate. This accommodates for clutch wear.

06 Some bearings of internal slave cylinders are not designed to be constantly spinning. In this case, an air gap is required between the spinning clutch assembly and the throwout bearing. The same is generally true for a system that includes a clutch fork, whether that system is fully mechanical or hydraulic. Specific air-gap specs depend on application but can be found in a service manual or instructions included with the kit.

07 A crude but effective example of how a throwout bearing works is demonstrated on a common rolling work stool. Since the seat spins freely, we're using it as a stand-in for the engine's flywheel. The pressure plate bolts to it with the friction disc sandwiched in between. With your author's hand as the clutch fork, notice how the base of the throwout bearing remains stationary as the face spins with the pressure plate. Pushing on the pressure plate diaphragm spring disengages the clutch.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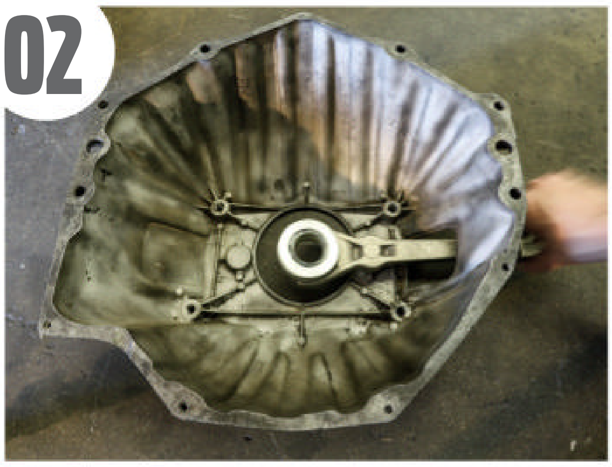
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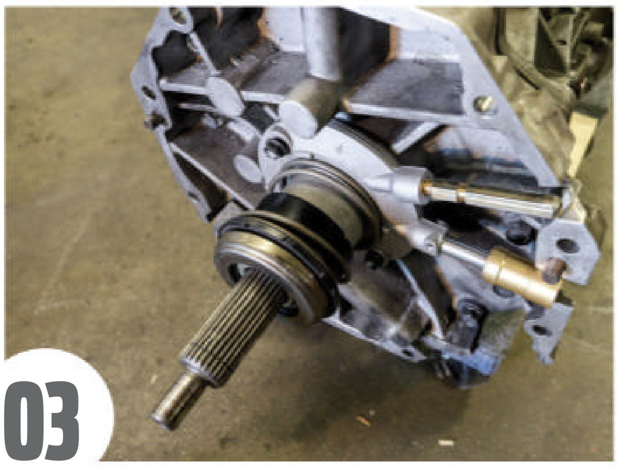
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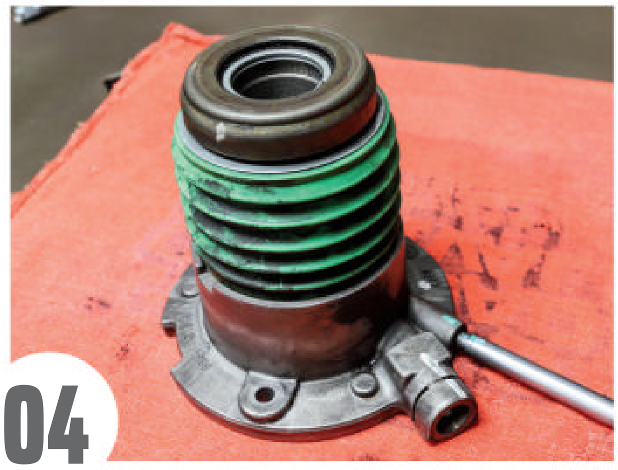
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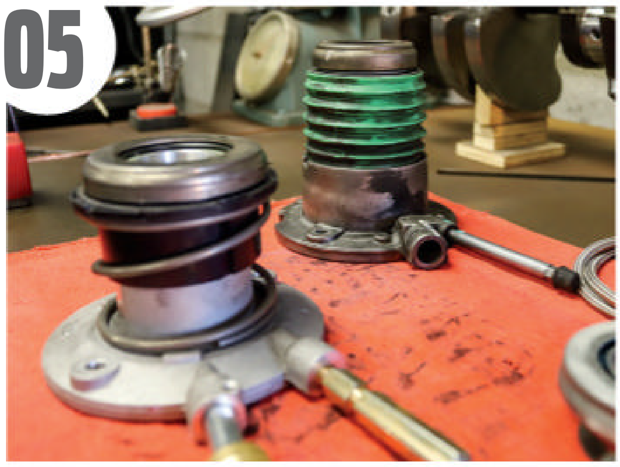
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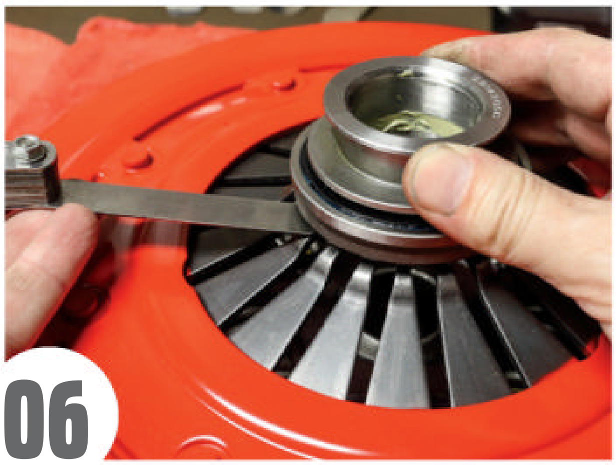
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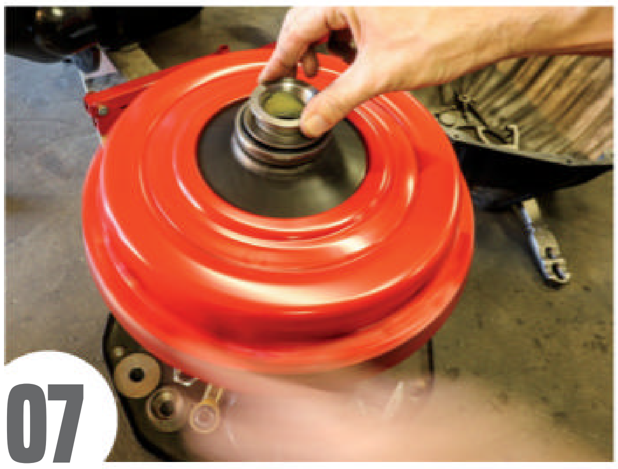
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Symptoms of a Bad Throwout Bearing

The throwout bearing is a simple devise that should provide years of long life. They are made with a sealed bearing assembly that doesn't require maintenance or lubrication. When a bearing goes bad, you will hear a grinding or whirring noise whenever the bearing is spinning. In a system where the bearing is in constant contact with the pressure plate, you will hear the noise all the time, though it may be louder when the clutch pedal is pushed in, putting the greatest load on the bearing surface. In systems with an air gap between the bearing and pressure plate, you will only hear the noise when the clutch is pushed in and the bearing is spinning. The sound will go away when you take your foot off the clutch pedal. If your throwout bearing is bad, you have no choice but to remove the transmission to replace it. That's why it can cost so much money to replace an inexpensive part.

WHY RUN DUAL 12-VOLT BATTERIES; WOULDN'T THIS GIVE YOU A 24-VOLT ELECTRICAL SYSTEM?

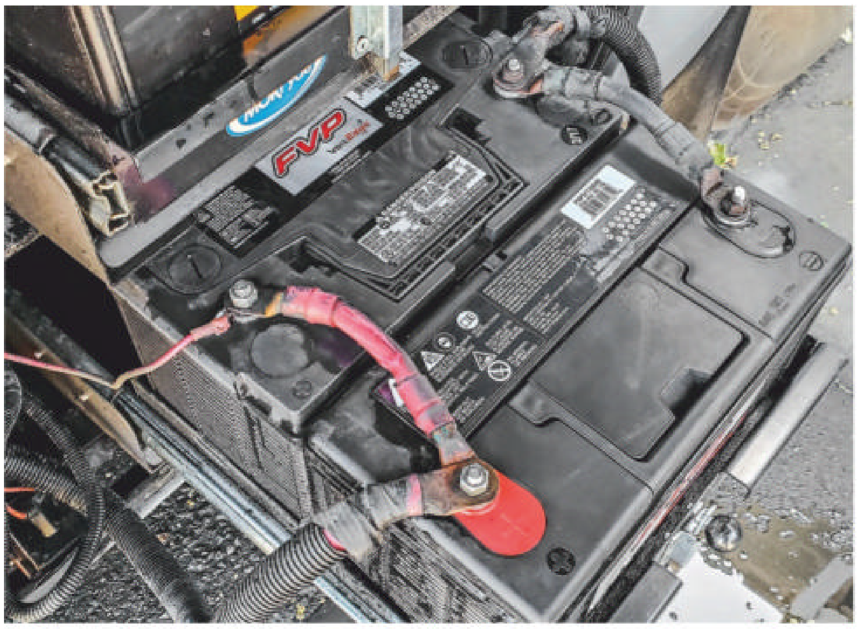
Cars, trucks, RVs, and motorhomes run dual 12-volt batteries for various reasons. Depending on how you wire a two-battery 12-volt system, the result can be a 12-volt system or a 24-volt system—or even both 12 volts and 24 volts.

- There will be 12 volts (about 14.2 volts with an alternator) if the batteries aren't wired together but kept isolated from each other. You can have two separate harnesses or use a battery isolator or selector switch.
- There will be 12 volts if the batteries are wired together in *parallel*: positive terminal to positive terminal, and negative to negative. Amp output will be the sum of the multiple batteries wired this way.
- There will be 24 volts (about 28 volts with an alternator) if two 12-volt batteries are wired together in *series*: Connect the positive terminal of one battery to the negative terminal of the other battery. Voltage doubles, but amps stay the same.

Dual-battery use examples include the following:

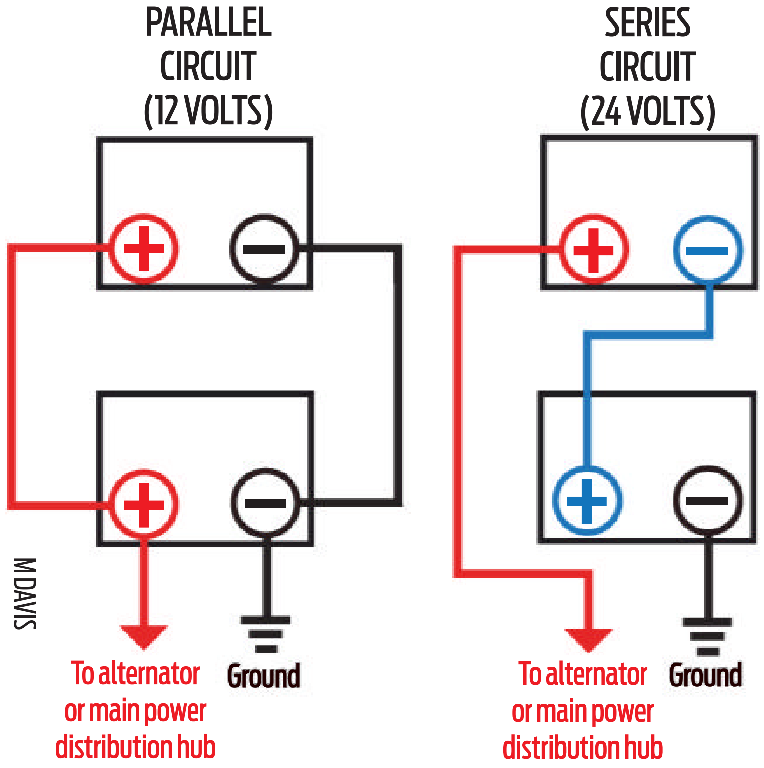
Race car ballast: Two trunk-mounted batteries can supply critical ballast, especially in classes where the rules prohibit dedicated ballast.

Drag-only car without an alternator: If you're not running an alternator but using a modern high-output ignition system and other current-hungry devices (such as an electric water pump, an electric fuel pump, trans-brakes, nitrous solenoids, and delay boxes) in a drag car, one battery can be dedicated to just the ignition system, while the other feeds the remaining current consumers.



Ron Rollings

Multiple 12-volt batteries wired in parallel—positive to positive; negative to negative—are still 12 volts, they just put out more amperage, which is always good for a current-hungry motorhome.


PARALLEL CIRCUIT (12 VOLTS)
SERIES CIRCUIT (24 VOLTS)
To alternator or main power distribution hub
Ground
To alternator or main power distribution hub
Ground
M DAVIS

Marlan Davis

In basic form, here is the difference between wiring two 12-volt batteries in series versus in parallel. The parallel circuit still generates 12 volts but doubles the amperage output. The series circuit yields a 24-volt system, but the amperage does not change. Twenty-four volts to the starter and solenoid makes it crank twice as fast as 12 volts.

MULTI BATTERY ISOLATOR
P/N : 904
MAX ALT AMPS 200
DC VOLTS 50V MAX
NEGATIVE GROUND

Summit Racing

A battery isolator separates the auxiliary battery from the primary battery, ensuring extra loads will not drain the battery. Powermaster PN 904, shown here, has a 200-amp rating and (as of June 2020) goes for $143.99 at Summit Racing.

High-end "show" cars with high-zoot sound systems: A separate battery dedicated just for the sound system and isolated from the rest of the electrical system might be needed if the car sits in a parking lot with the speakers blasting out the big vibes for an extended time period. A setup like this would include two batteries, a mechanical marine dual-battery selector switch, and a battery isolator. This lets the alternator recharge both the main battery and the auxiliary battery when the car is running, but when shut down only the auxiliary battery used to power the sound-system discharges.

Hard cranking with high compression and lots of advance: Running multiple batteries in parallel generates more cold-cranking amps during crank, though voltage is still 12 volts. Today's performance batteries and starters are so efficient that this isn't usually an issue; before you do anything, first check for excessive voltage drop or bad grounds on the starter cables, not a weak battery or starter.

Ultimate cranking power: When even two 12-volt batteries in parallel can't get the job done, or if you're the emergency service vehicle that must, by hook or by crook, start anything, it's time to juice 24 volts by wiring the batteries in series. Connect the positive terminal of one battery to the negative terminal of the other battery (see illustration). This supplies more cranking power than even two 12-volt batteries wired in parallel. Intermittent-duty starters can handle 24-volts, well, intermittently.

Full-time 24 volts: If it's good enough for a jet fighter, it's good enough for my car. Besides, I just drool over all those trick parts at the surplus store. Trouble is, a full 24-volt conversion in a car may be impractical in the real world. Constant-duty car accessories won't withstand 24 volts for long (if at all), and 24-volt substitute equivalents for everyday car parts might not be practical or available. (But if two 12-volt batteries are wired to yield a 24-volt system, you can still use a 12-volt alternator to charge them.)

Dual 12/24-volt system: Yet another wiring "twist" is to use a Littelfuse (formerly Cole Hersee) continuous-duty solenoid to create a "series/parallel" distribution circuit that generates 24 volts under crank, then defaults back to 12 volts to power everything else under normal running conditions. **Marlan Davis**

Sources

Littelfuse Inc.; Chicago, IL;
773.628.1000; littelfuse.com

Powermaster Motorsports;
W. Chicago, IL; 630.957.4019
(sales) or 630.849.7754 (tech);
powermastermotorsports.com

Summit Racing Equipment;
Akron, OH; 800.230.3030 (U.S.)
or 330.630.3030 (outside U.S.);
summitracing.com

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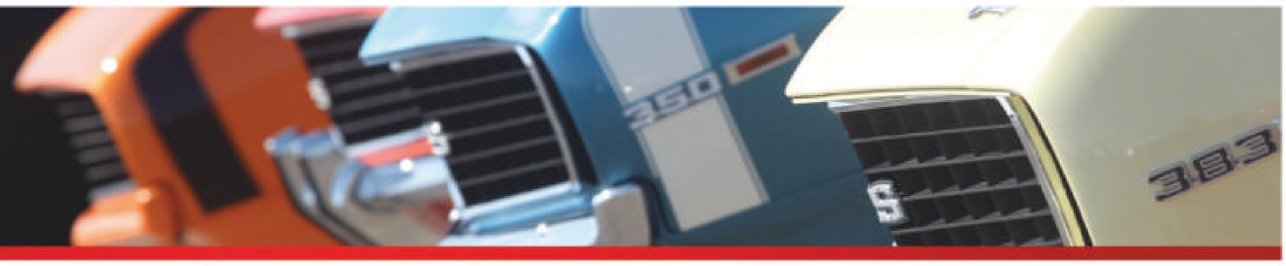

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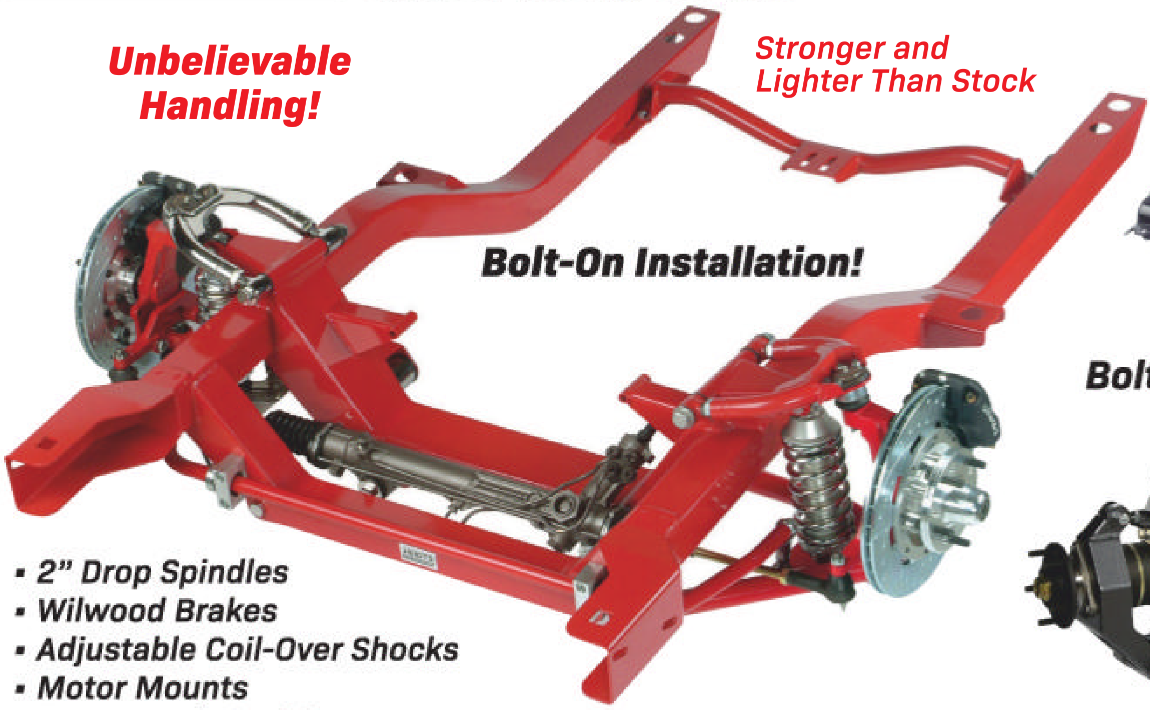

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How To Repair Your Dash and Flock the Top!

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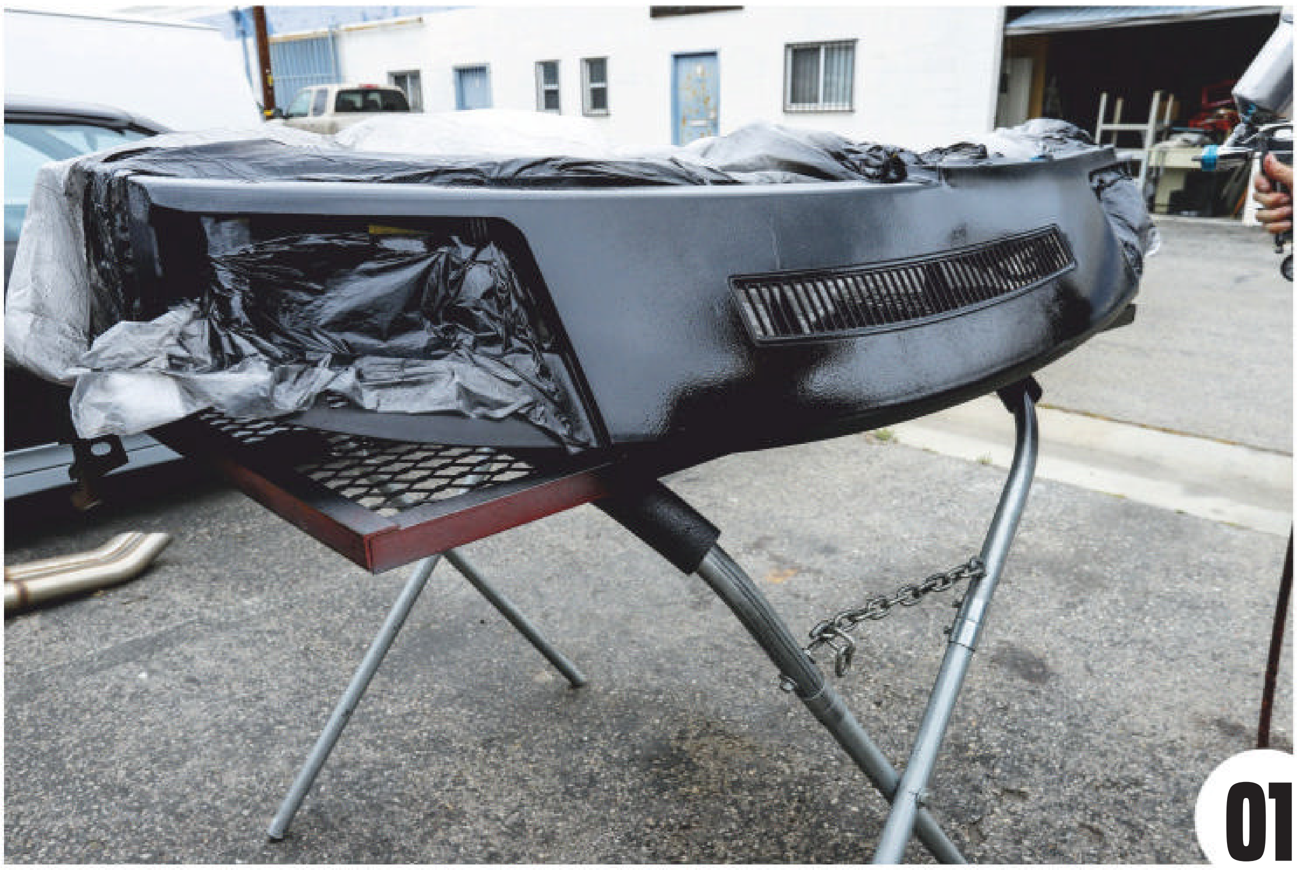
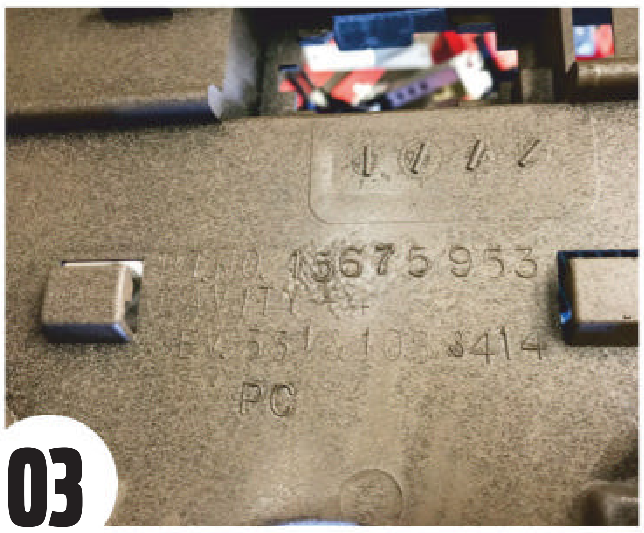
John McGann



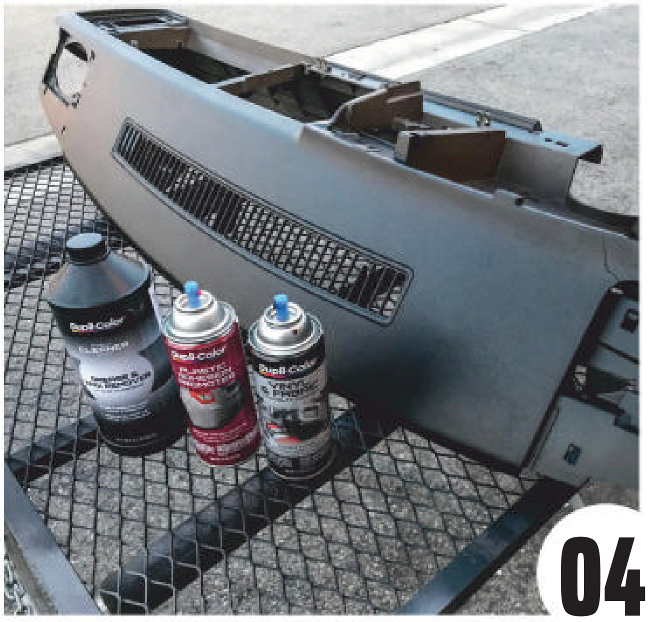
01 You've likely seen it on the dashboard of many race cars, though you may not have known what it was called. That suede-like treatment is done by a process called flocking. It's a simple, do-it-yourself process that yields a custom touch, but it is also functional. The reason you'll see many race cars with flocked dashboards is because the flocking virtually eliminates glare in the windshield caused by sunlight reflecting off the dashboard.

There are other ways to create this look, of course. You could apply real suede or Alcantara (the brand name of a synthetic microfiber material) upholstery to the dashboard, but that may be beyond the skills of the average enthusiast. Flocking is as easy as applying a liquid adhesive, spraying on the flocking fibers, and letting the part dry for a day. It's not very expensive, either.

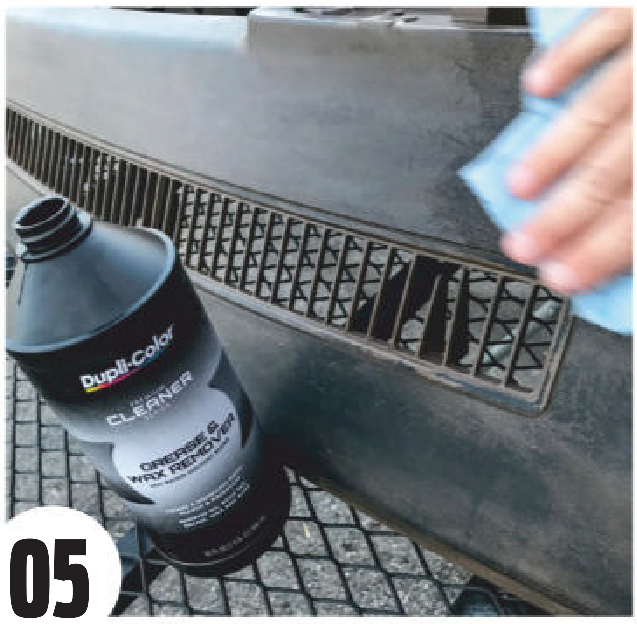
02 We applied flocking to a GMT400 pickup dashboard we plucked from the junkyard. It's destined to replace the sun-damaged piece in our 1993 GMC Sierra, but before installing it, we decided to change the color and to add flocking to the top. The process is pretty basic.



03 Several different types of plastics are used by the automotive industry, and certain chemicals and coatings might not be compatible with them. Most plastic pieces have identifying codes on the back or inside of the part. Our dashboard has the code "PC" molded into the manufacturing pad on the back. A quick search of the Internet verified our suspicion that this stood for polychloride. Likewise, the bezel surrounding the gauge cluster is marked with PPO—polyphenylene oxide.



04 Armed with the knowledge of what materials we were working with, we contacted Dupli-Color for guidance on what products to use. They recommended their Wax and Grease Remover, Adhesion Promoter, and Vinyl and Fabric coating to safely accomplish the color change we wanted.

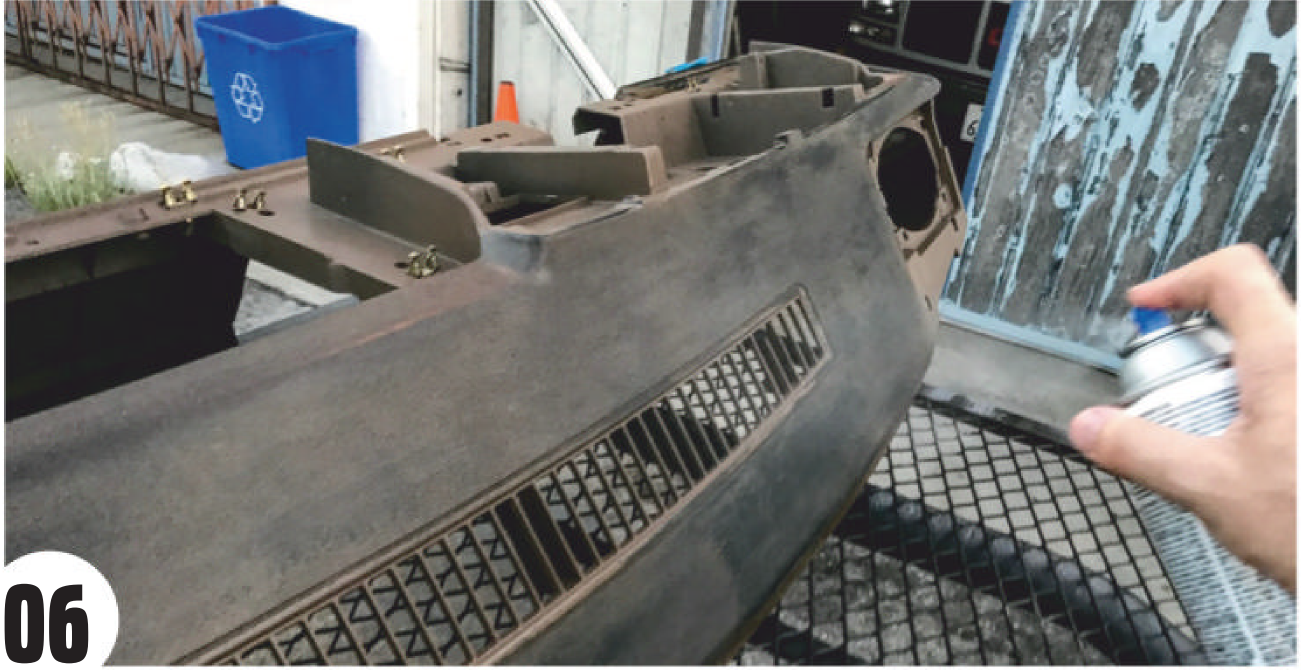


05 Here's where we admit to a mistake and offer it as a warning for you to avoid. Prior to receiving the Dupli-Color products, we used a surface prep that seemed to be too harsh for our plastic dash. It removed the stock coating and caused some slight cracks to form in the surface of the plastic, even though the package said it was safe for use on plastics. The damage is visible in this picture and looks like the cracks that form in a dry lake bed.

The lesson: *always* check the compatibility of chemicals on an inconspicuous location.

Source

Flock It!; 815.986.1097; flockit.com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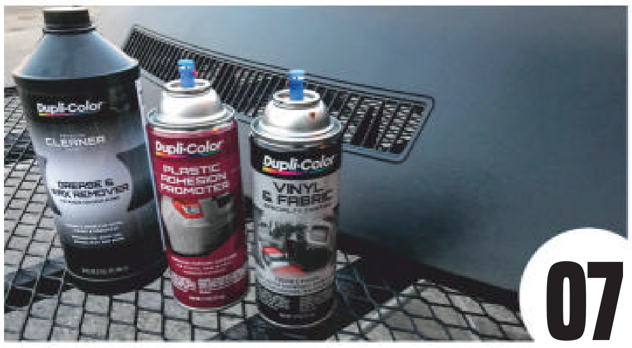

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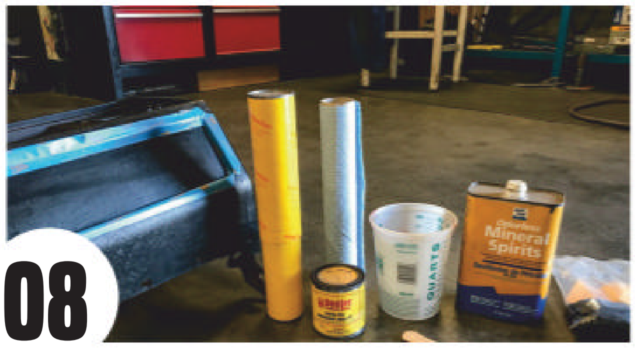

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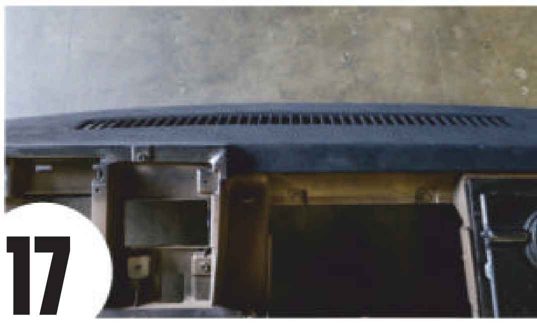
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06 Following the Wax and Grease Remover (which was a mild solvent that did not damage the plastic), we applied three coats of the Adhesion Promoter. It's a clear coating that does just what the name implies. It's recommended to follow up with the topcoat within 10 minutes of the last coat of Adhesion Promoter.

07 Dupli-Color's Vinyl and Fabric coating is available in 12 different colors, and we chose satin black. We sprayed it on in three light coats, and it offered excellent coverage and an outstanding finish.

08 This picture shows some of the damage caused by the incompatible solvent we initially used, and that's why we figured adding flocking would be a good way to cover up that damage. Before flocking the entire top of the dashboard, we tested the process on this smaller area to see if there would be a reaction between the adhesive and the vinyl coating. There wasn't.

09 As mentioned already, the flocking process itself is very simple, and our kit from Flock It came with everything we needed: the adhesive, a 1-pound bag of flocking fibers, and a flocking fiber applicator. The adhesive comes in a variety of colors to match the fibers. It can be applied with a brush, roller, or thinned with mineral spirits and sprayed.

10 The results looked pretty good, and the key is to add a relatively thick coat of adhesive and then immediately start sprinkling on the flocking fibers. You only have about 15 minutes before the adhesive starts to dry past the point where the fibers no longer stick.

11 Before flocking the top of the dash, we used JB Weld to repair some structural cracks on the top of the dash and on several of the mounting tabs on the back side. After the JB Weld cured, we sanded the repair area flat with 220 grit sandpaper.

12 Flock It's instructions recommend rolling or spraying the adhesive on larger areas like the top of our dashboard. Brushing it on could take too long. By the time you get to the end, the place you started is getting too dry for the fibers to stick properly. That's why we decided to spray the adhesive. We masked off the surface to be coated and wiped it with Dupli-Color's Wax and Grease Remover.

13 There really isn't a mix ratio for thinning the adhesive with mineral spirits, so we eyeballed the viscosity on our stir stick. We probably could have thinned it a bit more than we did. Our spray gun was equipped with the biggest fluid tip we could find: 1.8. Something bigger like a 2.0 tip would have been better. Basically, you should set the gun up as if you were spraying a thick primer filler.

14 We sprayed on three medium to heavy coats of the adhesive with only a few minutes between each coat. The adhesive is pretty thick so there's little risk of it running or sagging.

15 We began applying the flocking fibers immediately after spraying on the last coat of adhesive. Flock It's fiber applicator looks like a big saltshaker, but it's actually a tube that fits inside a bigger tube, and you pump the fibers out like you're pumping an old-fashioned bug sprayer. Don't be stingy with the flocking fibers, either. The more you apply, the better the results will be. Also, try to vary the direction you apply the fibers from or else you will have what looks like waves in the sea across the top of your dash.

16 After about 20 minutes, the adhesive was dry enough to remove the masking tape. We were pleased with the uniform coverage of the flocking and its overall appearance. Plus, it covered up that crack near the speaker opening.

17 Flock It's Suede-Tex Mini Flocker kit only costs about $35, and it comes with one 8-ounce can of adhesive, a 3-ounce bag of flocking fibers, the flocker applicator, and a paint brush. We purchased an additional bag of flocking fibers for a little more money, but the basic kit would have been sufficient to cover the dash. That, plus whatever your time is worth, adds up to an incredible bargain that results in a cool, unique, and functional treatment. Admittedly, this job was much easier to do with the dash out of the car, but if you plan for extra time and plenty of masking materials, this job could be done in the car as well.

ON THE SCENE

Rare "Big Daddy" Roth Photos!

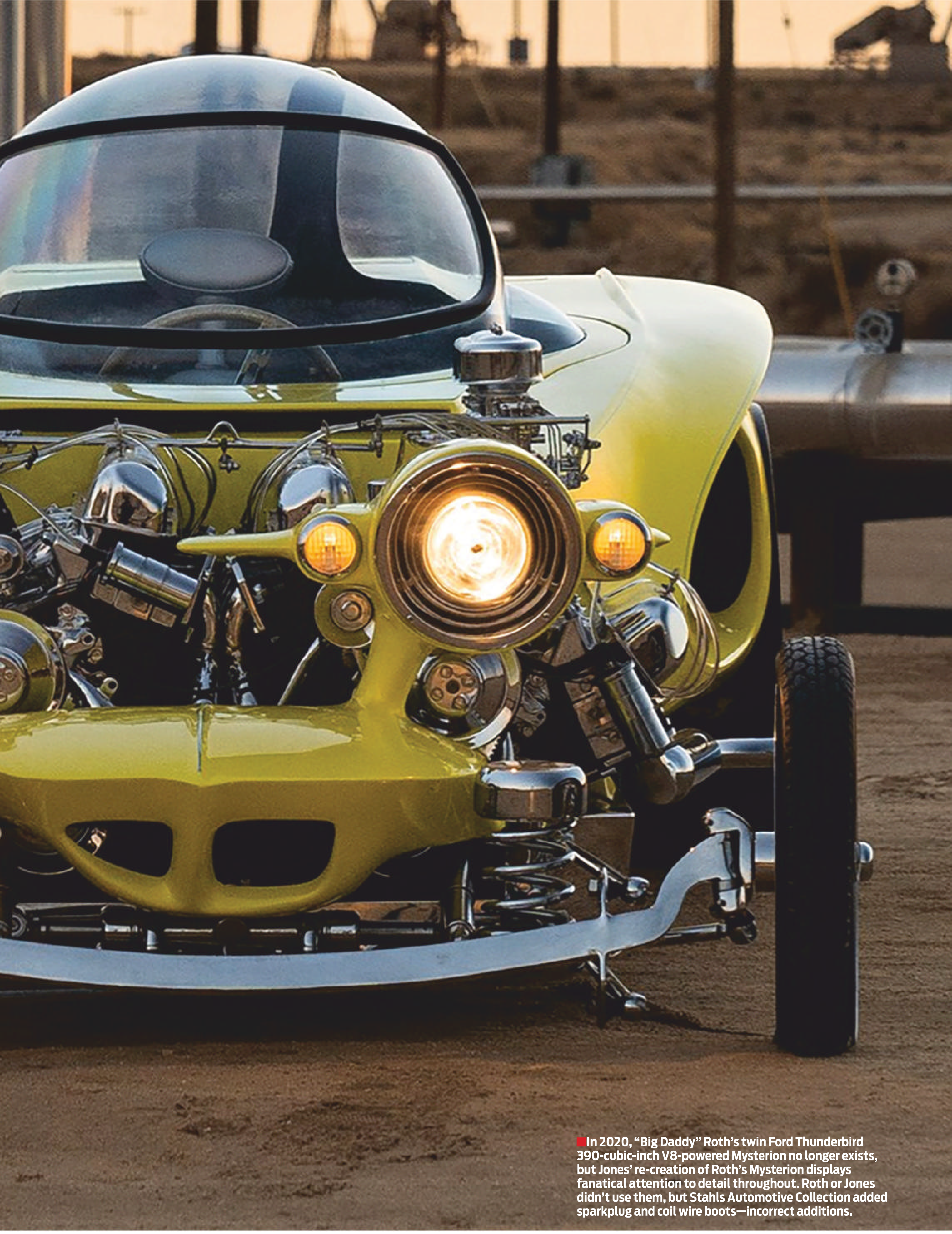
1950 Olds Rocket 88-Powered Mysterion.

I've said it before, and I'll say it again: "Big Daddy" Ed Roth built the fun stuff, wild, whimsical cars that tickled the fancy and pickled a kid's imagination for life. Back in the day when Roth was at the peak of his artistic career, creating cars like the Mysterion, we were all snot-nosed little kids, and it was square to call him "Big Daddy" Ed Roth—simply "Big Daddy" Roth or just "Big Daddy" was how the cool guys said it.

In 2020 "Big Daddy" Roth's Mysterion exists mostly in the memories of those who saw it in person, but thanks to Jeffery Jones, a guy most likely as much a madman artist as Roth himself, re-created a fantastic version of the Mysterion. The lead image for this story is of Jeffery Jones' Mysterion, and for those who know how to read, check out the book Jones wrote, *Ed Roth's Mysterion: The Genesis, Demise and Recreation of an Iconic Custom Car*.

There's no doubt after writing the book and building the car that Jones is the world's leading authority on the Mysterion. In the earliest stages of mocking up, Roth had a pair of 1950 Oldsmobile 303-cubic-inch V8 engines in place with Hydramatic transmissions. The Ford Motor Company via Bud "The Kat from AMT" Anderson got wind of the build thanks to a *Rod & Custom* article and shipped three big-block FE engines to Roth.

John Gilbert HOTROD Archives



In 2020, "Big Daddy" Roth's twin Ford Thunderbird 390-cubic-inch V8-powered Mysterion no longer exists, but Jones' re-creation of Roth's Mysterion displays fanatical attention to detail throughout. Roth or Jones didn't use them, but Stahls Automotive Collection added sparkplug and coil wire boots—incorrect additions.

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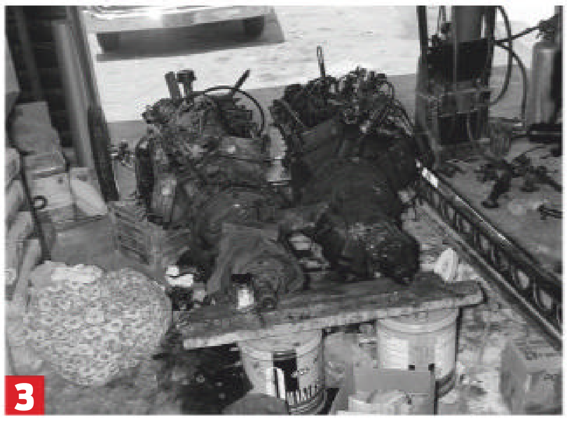

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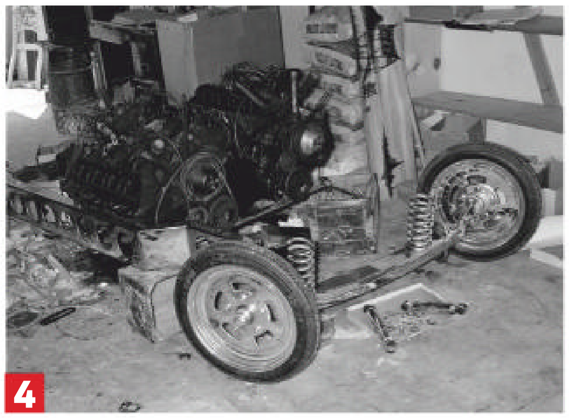

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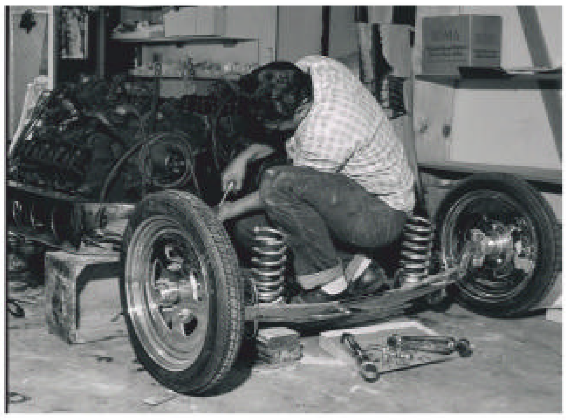
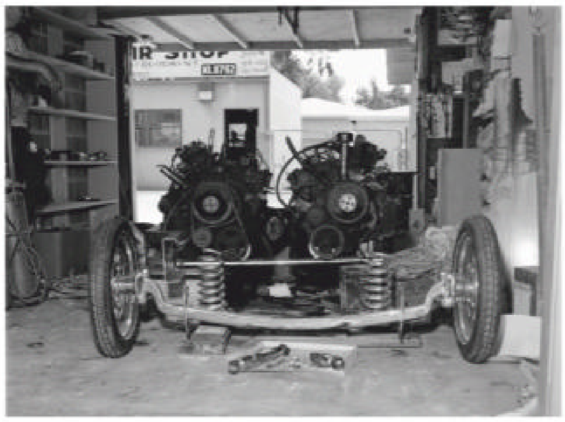
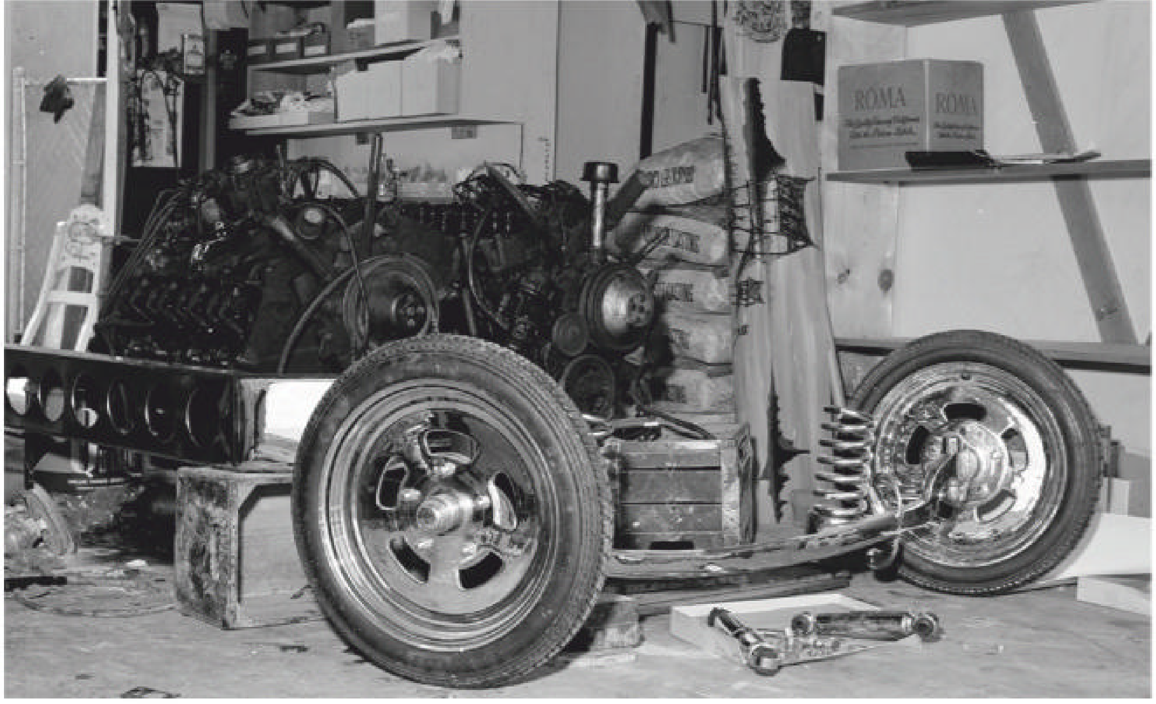




Some recollect they were high-performance 406-cubic-inch FEs, but after extensive research, Jones concluded they were T-Bird 390s. An engine swap that would create way more controversy now in the polarized 21st century than back then, Roth dropped the third Ford Thunderbird 390 engine into his 1955 Chevy gasser. It took some engineering smarts to turn the Mysterion's canted dual-engine configuration into something that could run and drive. One of the 'Bird 390 engines is a runner, and the other a dummy with its guts cut out to conceal an alternator spinning internally on a front two-main-bearings-supported jackshaft.

The sale of Jones' Mysterion at a Sotheby's auction—where it sold for a whopping $246,400, double what the car was expected to go for—held the car-collecting crowd in awe, but in reality, after the cost of materials and his time were factored in, it's likely Jones barely made a wage.

For those who would enjoy seeing Jones' Mysterion in person, the car now resides in the Stahls Automotive Collection in Chesterfield, Michigan.



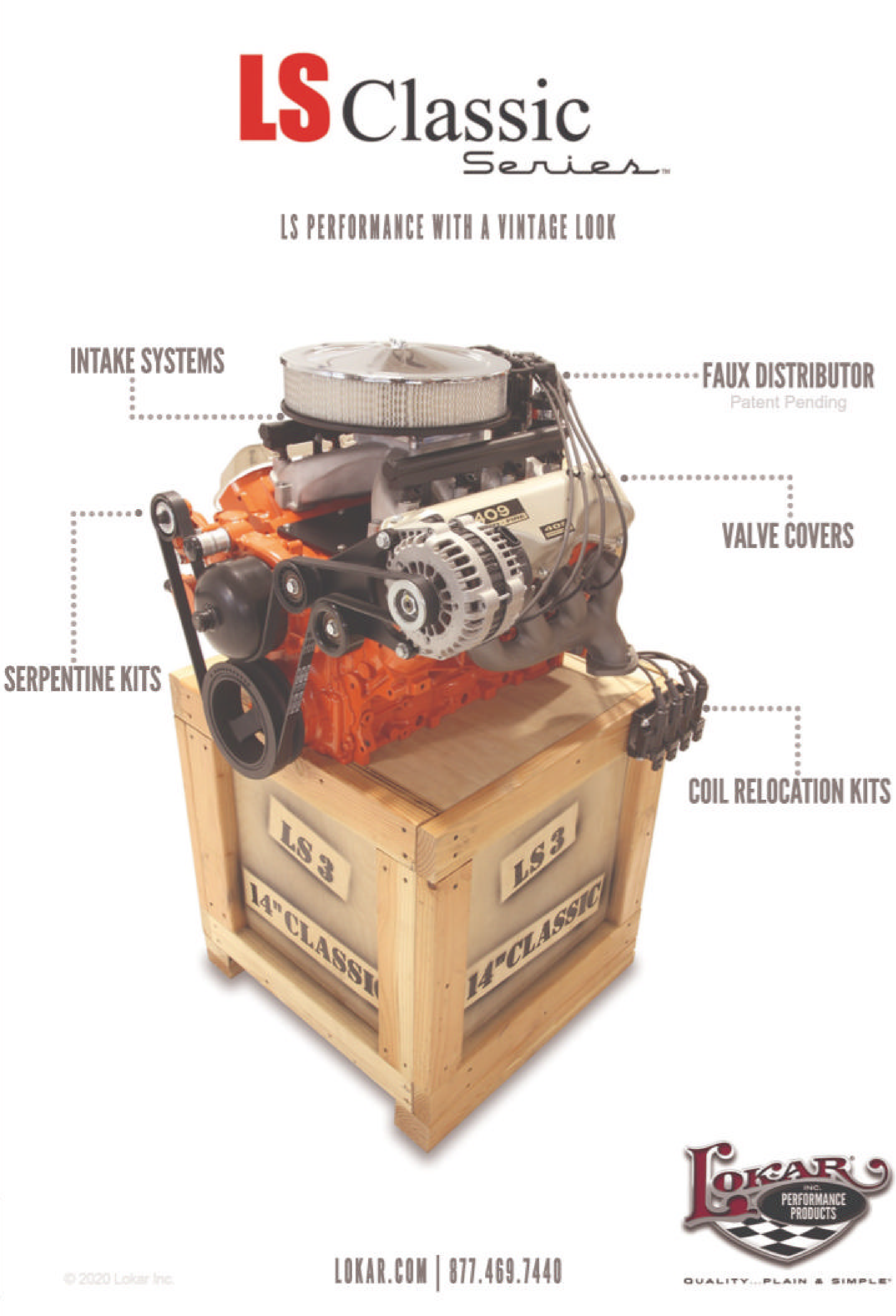
◂Opposite

1 Caught in the Olds V8 engine early R&D stages, here's "Big Daddy" Roth sculpting the iconic cyclops eyeball headlight mold. "Big Daddy" Roth's medium of choice to construct a car body was fiberglass laid up with a plaster mold. "Big Daddy" Roth never built one of his creations with a steel body.

2 Looking back at "Big Daddy" Roth's body of work, one realizes he was more an artist than he was a builder of custom cars to be driven. This view of Mysterion's frame rail reveals the wall thickness of the steel is too light a gauge to function as a platform to suspend two heavy Oldsmobile or Thunderbird engines.

3 If "Big Daddy" Roth's Mysterion had been relegated to a modern art museum in 1964, it would likely still be around today, but instead it was bounced in a trailer from custom car show to custom car show until the brittle frame, which Roth told differing descriptions about, buckled with the unbearable weight of two Ford FE big-block engines.

4 One can't help but notice there's fresh chrome on the Mysterion going way back to its earliest days in mockup. The frame rails are in chrome, and the front I-beam axle is chromed, as well. This means "Big Daddy" had the chrome plating done early on when the Mysterion was still Oldsmobile powered, or the chrome parts were scavenged from another Roth custom.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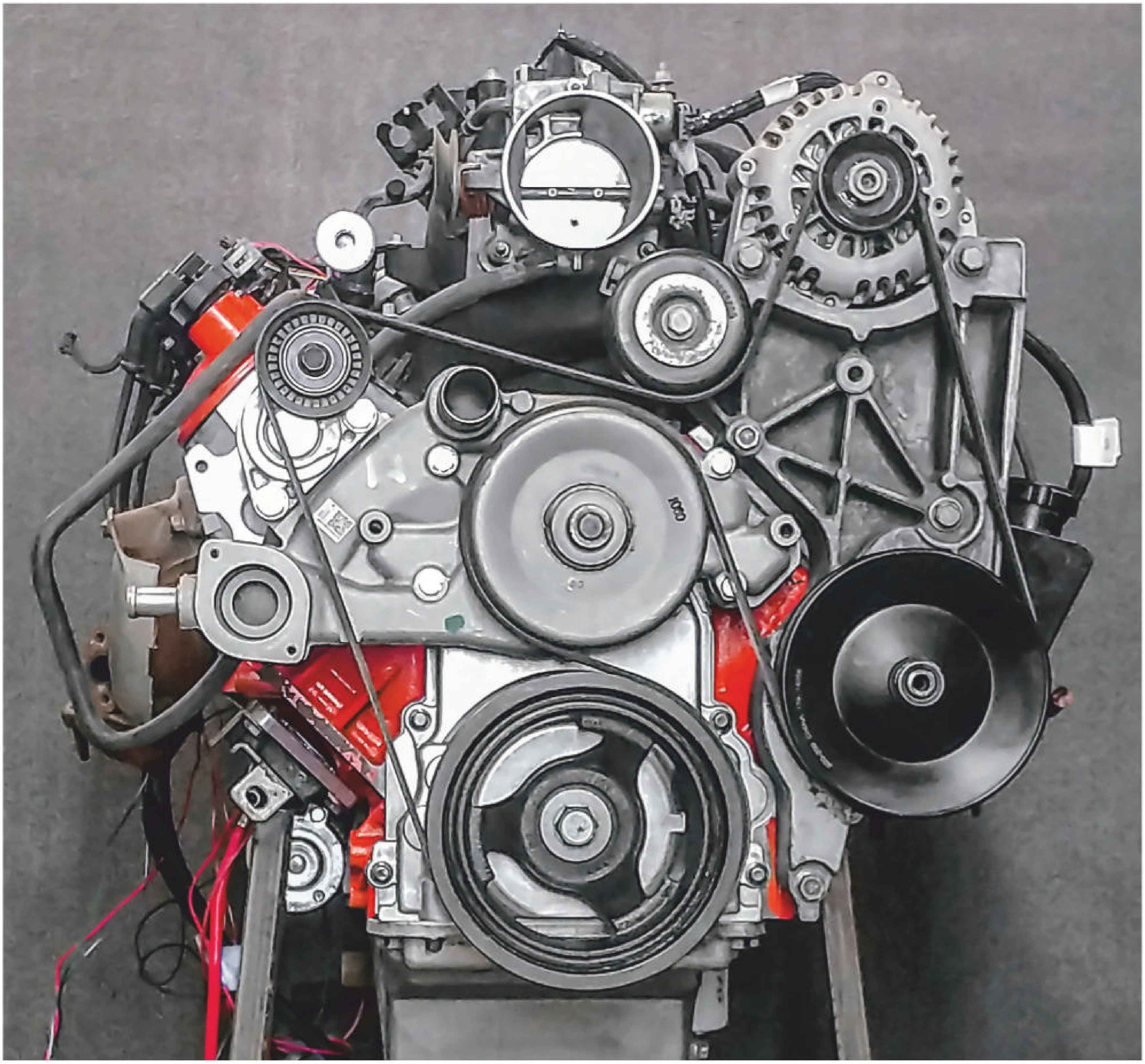
KWiK Performance

Peaceful coexistence: This short Corvette LS2 pump with forward, passenger-side outlet is installed with the original truck accessories, brackets, and balancer, thanks to water pump spacers and a Gates PN 38323 (or equivalent) tensioner. No problem with the production tall truck intake manifold, either.

John Hanna Asks...

Can I Run LS-Engine Car Water Pumps With Truck Front Drives?

Marlan Davis

Q: I have a 6.0L LQ4 engine out of a 2005 ¾-ton Silverado that I am installing in a 1957 Chevy Bel Air. The outlet on the water pump comes up and forward. It looks like the outlet on GM pump PN 12682286 (sic) might work better. Can you tell me if this pump would work on my engine?

A: John, car-type LS pumps have front exits, but other parts, including water pump spacers, may be necessary to make them work, depending on the parts you already have. Let's take it from the top: First, your above-referenced part number does not exist within the GM parts system. You probably meant PN 12681186 (casting No. 12681180), which is stock on 2005-2007 LS2, 2008 LS3, and 2007-2008 LS7 Corvette engines.

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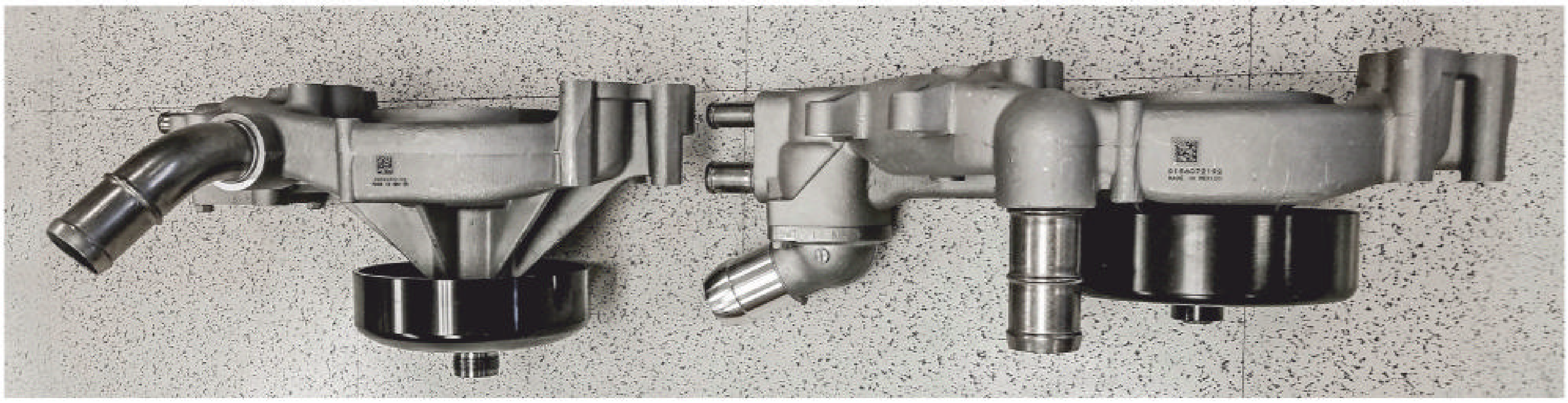


John Elway Chevrolet

An LS truck water pump (2005 6.0L LQ4 GM PN 12703898 shown, *left*) is about 1 $\frac{9}{16}$ inches longer than a typical short Corvette pump (LS2/LS3/LS7 GM PN 12681186, *right*). The truck pump's radiator outlet comes out the top and points up; the Corvette's comes straight out the front on the driver side. Note the narrow, "single belt-path" pulley on the LS2 pump.

The What to Do if You Don't Already Have All the Truck Accessory Drives Solution

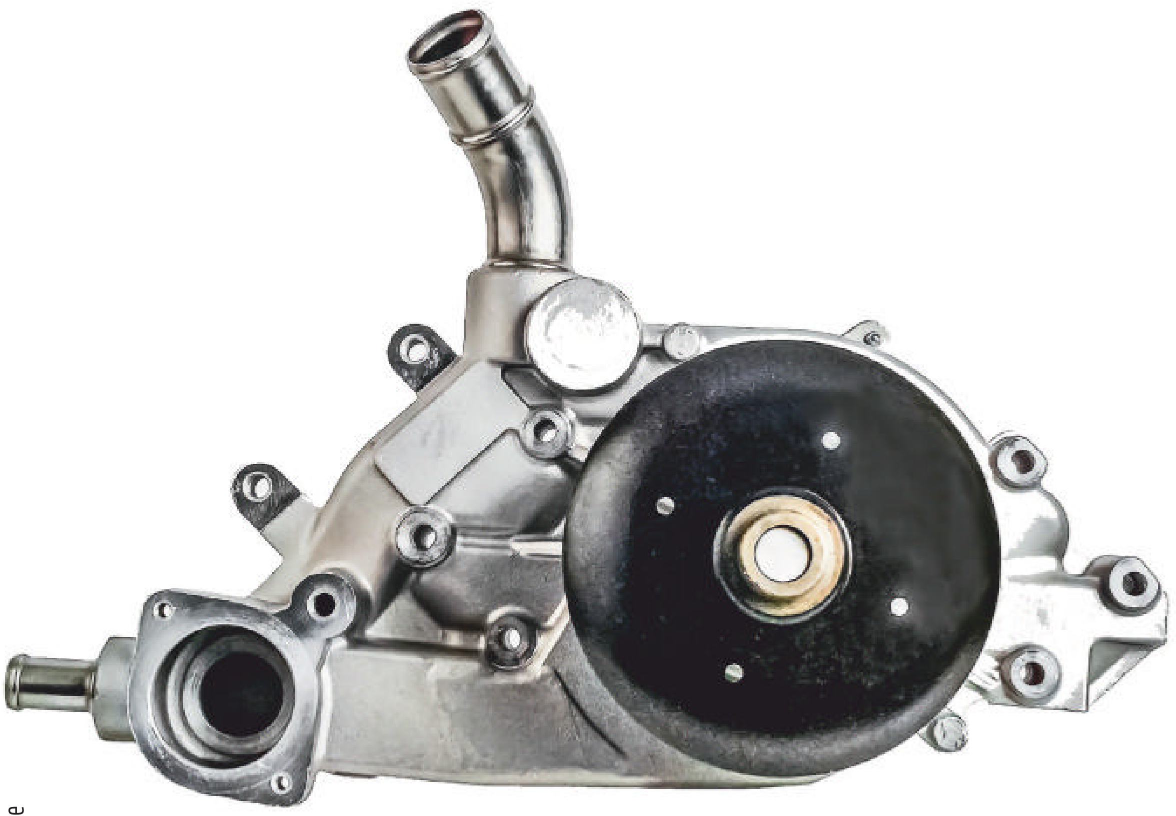
Although its passenger-side, front-exit outlet hose barb angle seemingly works better on many retrofit engine swaps, the "Corvette" LS2 water pumps are about 1 $\frac{9}{16}$ inches shorter than "long" truck pumps. The pump and its permanently attached pulley will bolt up to the truck block, but that pulley won't line up with the crank pulley that's machined into the harmonic damper. All Gen III and IV LS-type engines are internally balanced, so you could install, for example, a Corvette LS2 damper with its integral pulley (GM PN 12675715) onto your crank without any engine balance issues.

Installing an LS2 Corvette pump and a Corvette damper assumes you don't have any other accessories, brackets, and pulleys yet because—with just production-based parts—the short pump and balancer require corresponding Corvette-type accessories, mounting brackets, and pulleys to get everything properly lined up (including the A/C compressor, power-steering pump, and alternator). Chevrolet Performance, GM's official high-perf and racing parts program, sells several complete Corvette drive system variations under individual kit part numbers. Parts manager Ken Casey at John Elway Chevrolet stocks Chevrolet Performance, GM Service, and ACDelco parts at very friendly prices—be sure to mention you read about it in HOT ROD. There are also various aftermarket drive solutions available from outfits like Holley and KWiK Performance, some of which are compatible with both a short pump and the existing truck harmonic balancer.

But what if you already have all the truck drives and accessories? They sure won't line up with a Corvette water pump and balancer! Are there affordable solutions that don't involve changing out the entire stock front drive system?

You betcha! Here are several:

The Nearly Free, Do-It-Yourself Solution



Cardone

This Cardone LS truck long water pump (PN 55-13411) is a "universal" type casting with an extra blank boss that one could drill and tap with an appropriate-size front passenger-side outlet fitting.

Modify the existing truck water pump. This only works with some auto parts store universal replacement pumps, such as Duralast PN US64-T (online price, $119.99). On this pump and some other universal parts-store pumps, the casting has an extra blank boss on the front passenger side. Drill and tap the blank boss for a pipe thread fitting that matches the outlet hose diameter. Pipe elbows are available if needed for any clearance or hose-routing issues. Use a slide-hammer, large vise grips, or similar tool to pull out the old, now-unneeded, vertical fitting, then plug the open hole with an appropriate-size cup-plug or drill and tap it for a pipe plug.

The cost: Virtually free if you already have one of these "universal" pumps, except for your time and the appropriate-size drill bit, pipe tap, plug, and pipe fitting. If this makes you nervous, try to find an old, junk universal-style pump to practice on (you can always turn it in later as a core!). Don't want to take the risk? Try this:

Sources

ACDelco; Detroit, MI; 800.ACDelco; acdelco.com

Amazon.com; Seattle, WA; amazon.com

Cardone Industries USA; Philadelphia, PA; 800.777.4780 (customer service) or 888.280.TECH (tech assistance); cardone.com

Chevrolet Performance Parts; Detroit, MI; 800.577.6888 (nearest dealer); chevrolet.com/performance

Dirty Dingo Motorsports; Mesa, AZ; 480.824.1968; dirtydingo.com

Duralast Parts; duralastparts.com

Gates Corp.; Denver, CO; 303.744.5651; gates.com

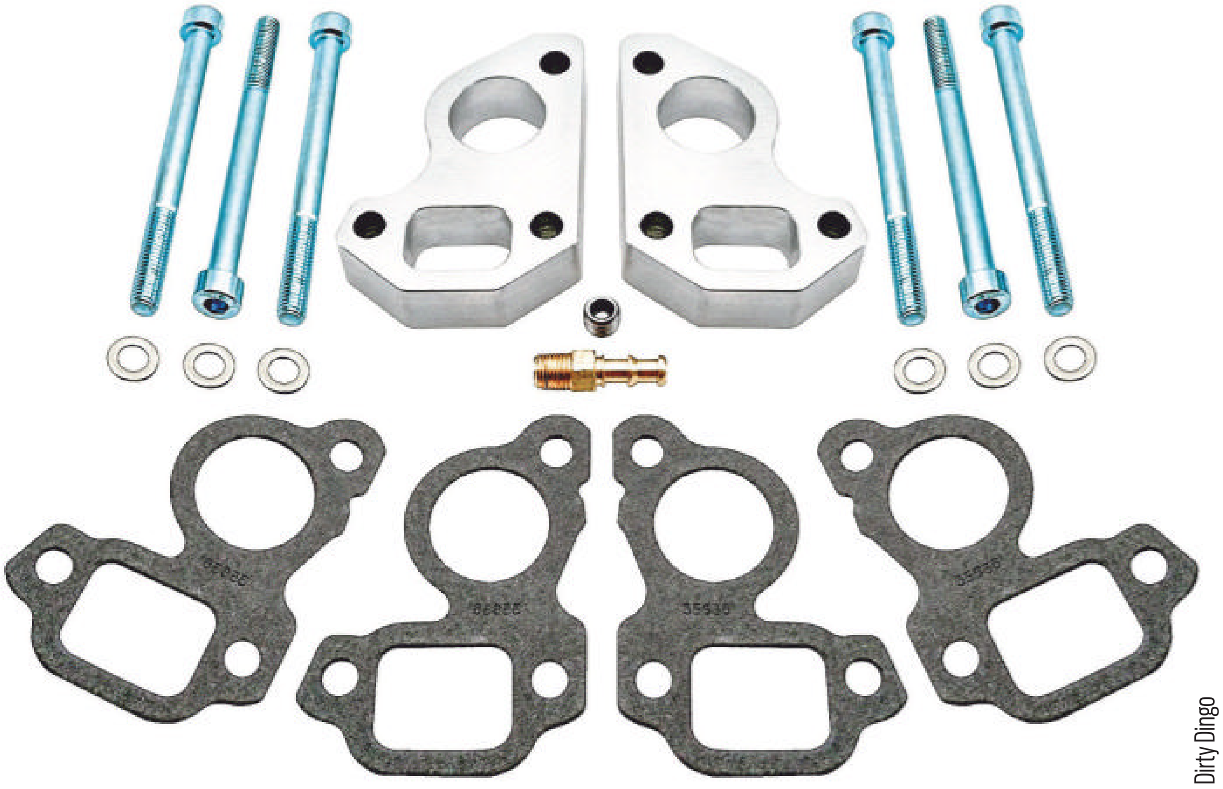
GM Customer Care and Aftersales; Grand Blanc, MI; 810.606.2001; genuinegmparts.com

Holley Performance Products; Bowling Green, KY; 800.HOLLEY1 (nearest dealer), 866.464.6553 (tech); holley.com

John Elway Chevrolet on South Broadway; Englewood, CO; 866.273.4757 or 303.761.5161; johnelwaychevrolet.com/Order-Parts-Online

KWiK Performance Inc.; Springfield, MO; 417.955.1467; kwikperf.com

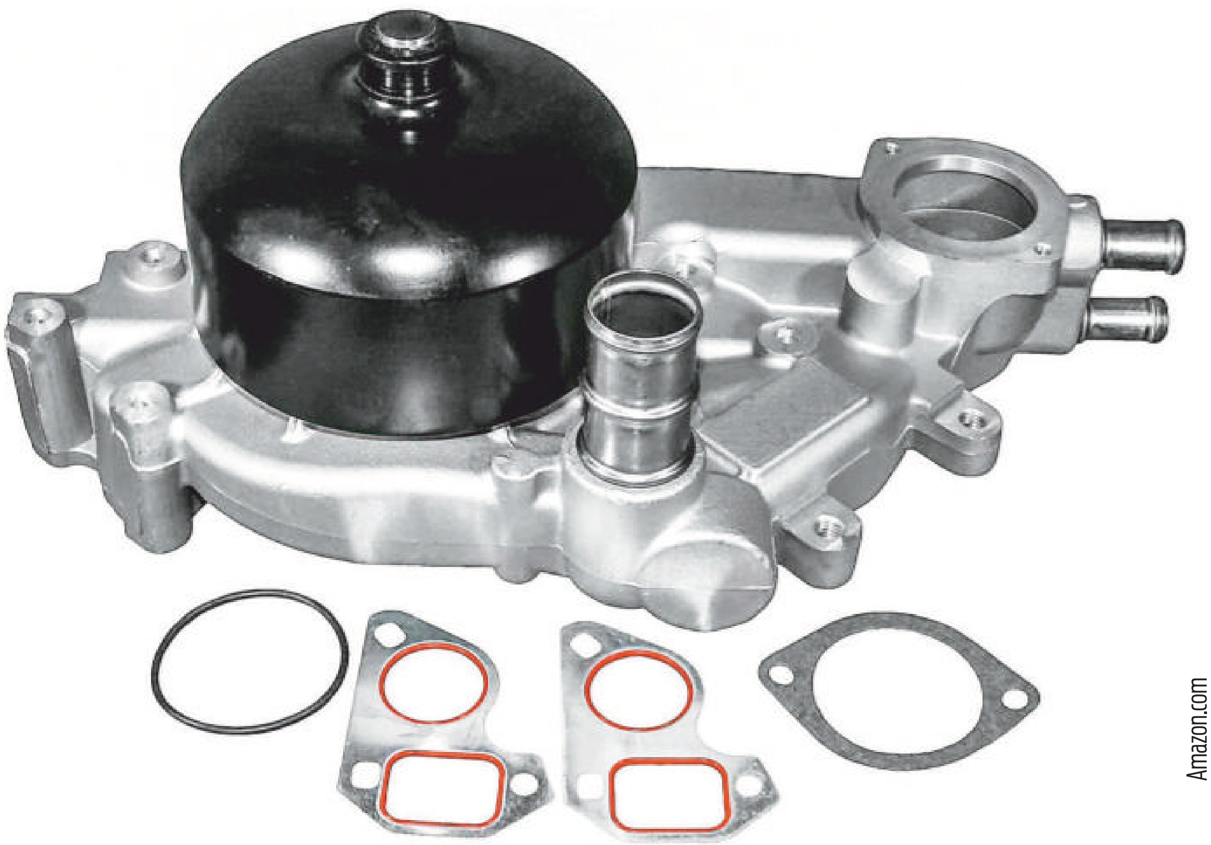
The Elegantly Simple, Make an Early, Short Water Pump Work Without Buying a Whole New Drive System and Balancer Solution


Dirty Dingo

■Dirty Dingo offers this LS1 water pump truck spacer kit (PN DD-LS-WP-SP1) that allows using the LS1 short pump with existing truck long water pump accessory-drive systems. One of the spacers even comes tapped for a 1/8-inch NPT nipple to connect the engine bleed hose if using a radiator without bleed-line provisions.

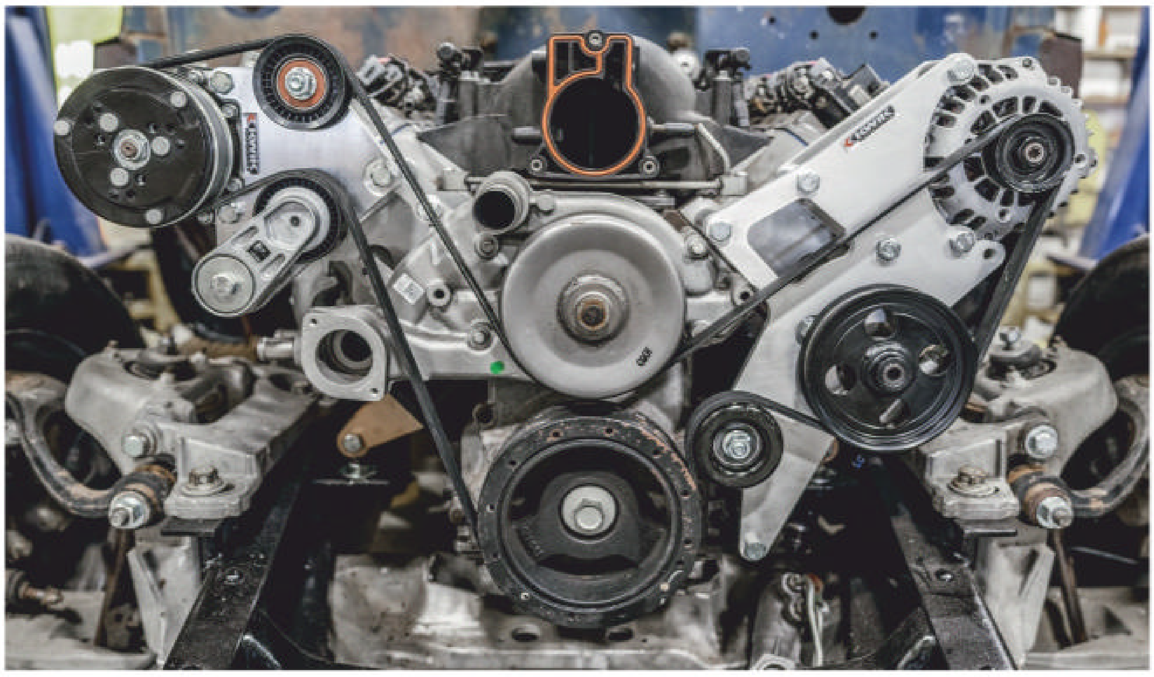
Buy or fab LS water pump spacers! One aftermarket source is Dirty Dingo Motorsports, which sells an LS1 water pump spacer kit (PN DD-LS-WP-SP1, $49.99) that moves an early short Corvette LS pump forward ¾ inch to line up with the existing truck crank and accessory pulleys.

Dirty Dingo's kit requires the use of an early short LS1 pump. Not the LS2 pump referenced at the beginning of this answer, the recommended pump for Dingo's kit came stock on the 1998-2002 Camaro/Firebird, 1997-2004 Corvette, and 2004-2006 GTO (GM dealer, PN 12681185; ACDelco Professional, PN 252-846). It has a broad, bell-like pulley, which is why—in its OE application—it works with both the Corvette and Camaro Gen III front-drive system, even though the original applications used slightly different-length balancer pulley offsets. This pump won't work on later engines with VVT (variable valve timing; not applicable to your 2005 6.0L LQ4 engine), because the early pump with spacers won't clear the taller VVT front cover. Due to slight alignment and bolt-pattern differences, also mandatory with this conversion is a new 1998-2002 Camaro/Firebird (not Corvette or GTO) tensioner and bracket assembly. (GM dealer/ACDelco Original Equipment, PN 12560344; $62.89 at Amazon.com).


Amazon.com

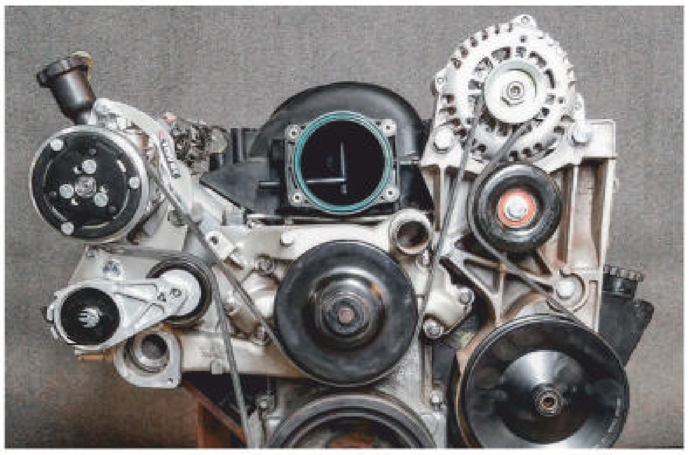
■With Dirty Dingo's kit, use the first-style Gen III LS car-type short pump from a Camaro/Firebird through 2002 or Corvette through 2004. Compared to the LS2 Corvette pump, the LS1 pump's dual-drive-path thick pulley is more tolerant of slight belt and pulley alignment variations. This is the ACDelco Professional version (PN 19195105 or 252-846), $99.72 at Amazon.com (as of May 2020).

If you insist on using the Corvette LS2 pump, a similar spacer concept could conceivably work, but the spacers need to be much thicker, around 1 9/16 inches. KWiK Performance says the LS2 pump with such thick spacers would work using Gates tensioner PN 38323 off a weird Mopar application.


KWiK Performance

■GM air conditioning compressors may not always play well with many aftermarket A/C setups. This KWiK high-mount drive-system mounts the popular Sanden compressor and compact car-style Type 2 power-steering pump using the long truck harmonic balancer plus the short LS2 Corvette water pump with its more favorable forward passenger-side outlet. Because it uses KWiK's brackets, the system requires no water pump spacers.

The What to Do if Running a "Short-Height" Car-Type Intake in Place of the Tall Truck Intake Solution



KWIK Performance

Throttle-body interference may occur if a shorter, car-type intake replaces the truck manifold. One solution: Relocate the idler pulley further toward the passenger side and use a 2010–2015 Camaro water pump with its driver-side front outlet long water pump, which lines right up with the truck balancer with no need for spacers. Also visible here are KWiK's bracket and tensioner for mounting a Sanden mini A/C compressor ahead of the cylinder head—a simple, one-belt solution.

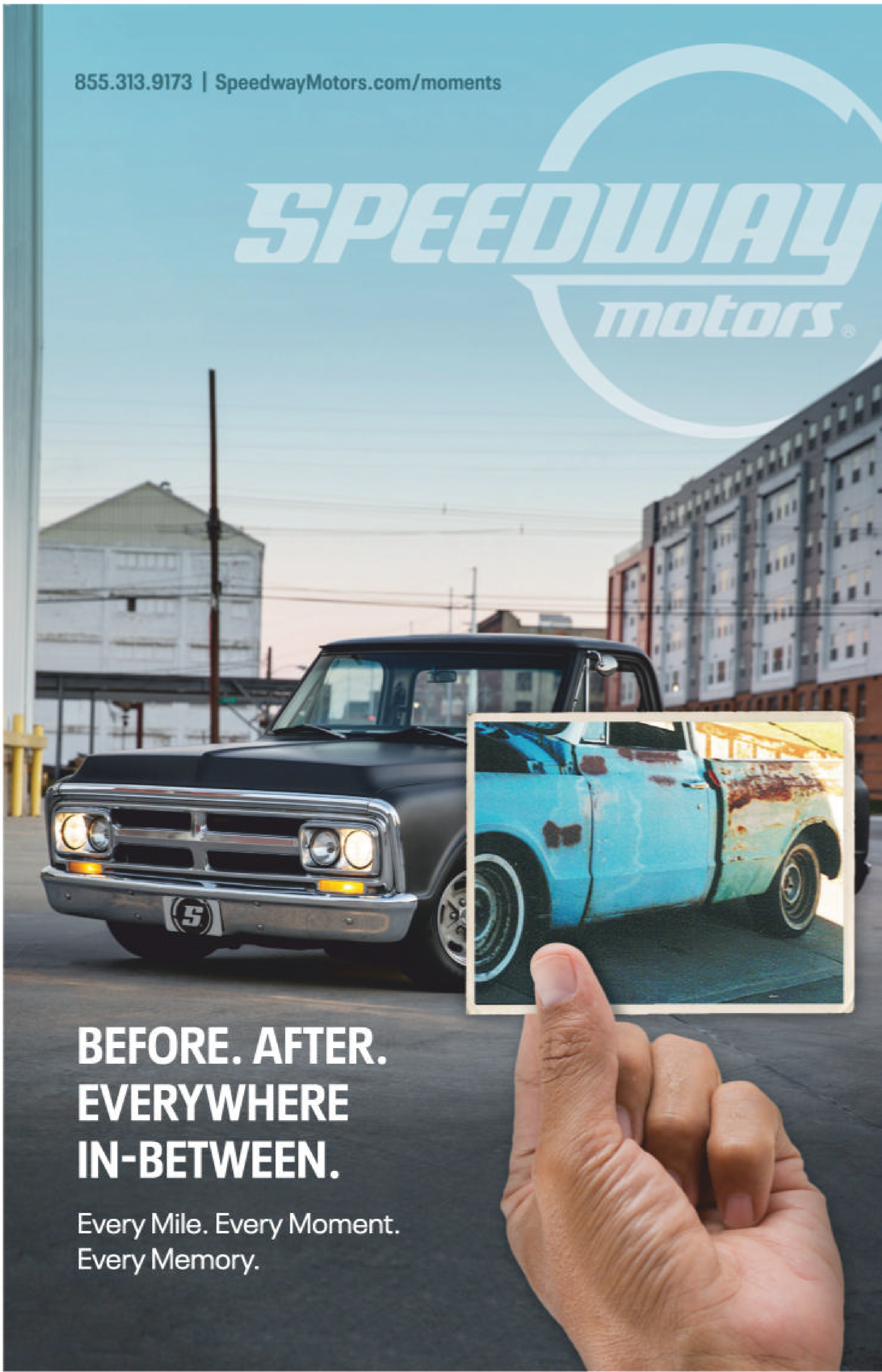
The methods discussed may not always work for those who have a truck long-pump system but can't use the truck water pump with its straight-up outlet fitting due to clearance/interference when installing lower car-type LS intake manifolds. If that's the case, consider the 2010-2015 Camaro water pump (GM dealer PN 19207665; ACDelco Professional PN 19339913 or 252-975, $149.81 at Amazon.com), whose water outlet also comes straight out the front, but on the passenger side. Unlike the LS3 Corvette short pump (which also has a driver-side outlet but still needs spacers), the late Camaro uses a "long" pump, with the correct belt spacing to match the truck balancer and clear the car-type inlet manifold throttle body and ducting without spacers. The problem is passenger-side, front-outlet, pumps—whether late Camaro or 'Vette LS3—run into the truck drive system's idler pulley on the passenger side between the water pump pulley and the alternator. If that occurs, you need to move the idler further toward the passenger side using Dirty Dingo idler pulley relocation kit PN DD-LS-IRB ($28.99). The relocation also requires hacking off the original idler pulley mounting ear on the truck's big alternator bracket plus a different-length serpentine belt. Or you could just replace the truck OE alternator bracket with a KWiK Performance bracket that moves the alternator further out to the side and is also set up for a Type II power-steering pump underneath. This pump is more compact than the integral-reservoir truck power-steering pump and easily adapts to remote reservoirs if needed.

Be Sure the Thermostat and Housing Match the Water Pump

One more tip: Over the years, there have been different thermostat housings and even thermostats themselves—not just the hose angle and opening temperatures, but in some instances, actual physical envelope and seal changes. If your truck housing and thermo won't fit, get the equivalent matching parts for the water pump you are installing. This may also differ between the original GM assembly-line parts and current service-replacement parts. Some new GM premium water pumps include a new housing and thermostat for this very reason (but, unfortunately, at a premium price).

How to Run Front-Exit LS Water Pumps With Truck Balancers and Front Drives

- For a passenger-side front exit, run early LS1 Camaro/Corvette short water pump with Dirty Dingo ¾-inch spacers and the LS1 Camaro tensioner or the later LS2 Corvette short water pump with $1\frac{9}{16}$-inch spacers and Gates tensioner PN 38323.
- For a driver-side front exit, run a 2010-2015 Camaro LS3/L99 water pump with no spacers, trim off existing truck idler pulley mounting ear, and move the pulley further toward the passenger side.
- LS thermostat housings and thermostats vary by angle, configuration, sealing gasket, and design—be sure they match the new pump (some new pumps include these items).



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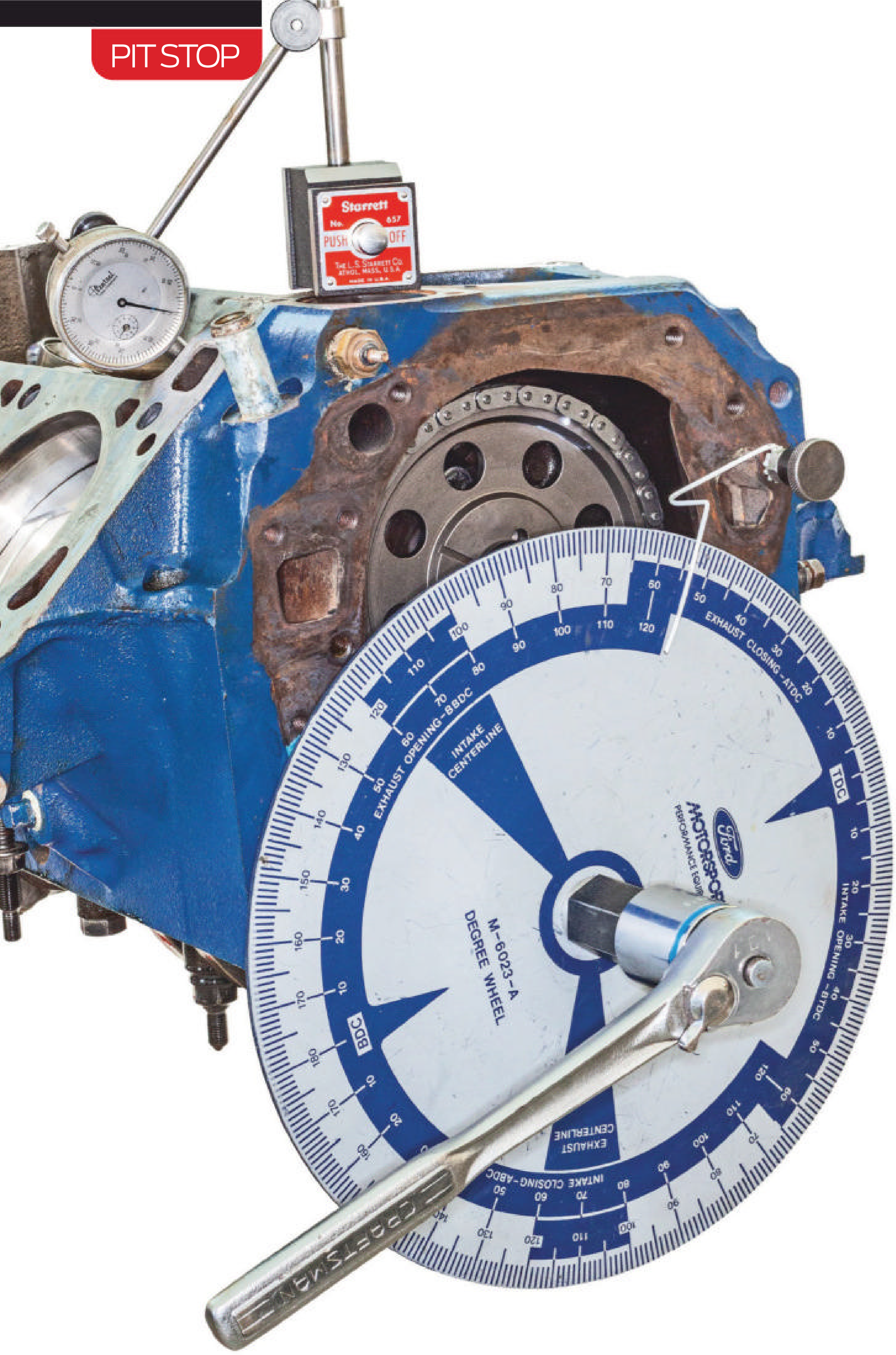
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Degree or Disagree?

Marlan Davis

Q: On a scale of 1 to 10, how important is it to do the [cam] degree step?

Rodney Johnson
Via email

Critical for achieving max cam performance, preventing piston-to-valve contact, and as a double-check against assembly errors, accurately locating TDC and degreeing in a custom cam should be a routine procedure for every hot rodder.

> **"You've got to ask yourself one question: 'Do I feel lucky?' Well, do you, punk?"—Insp. Harry Callahan (Clint Eastwood), "Dirty Harry"**

A: In a high-performance application, deciding whether you can skip degreeing a cam is like playing Russian roulette with an old-school six-chamber revolver. With only one loaded chamber, there's about an 83 percent chance of nothing bad happening after you spin the cylinder and pull the trigger. That's better odds than hitting the jackpot on a Vegas one-armed bandit, but are you willing to bet your life on it? There's still about a 17 percent chance of blowing your brains out.

What about splattering your engine? Are you willing to gamble your engine's life on cutting corners? What are my gambling odds of not degreeing a cam? Sooner or later, the House always wins—or does it?

What other parts affect accurately degreeing a cam?

With most manufacturers, cam accuracy is pretty spot-on these days, with the possible exception of a custom profile being ground straight-up (with the same LSA and intake centerline), even though for best performance that profile is designed to be installed a few degrees advanced (and the cam card's checking numbers reflect that).

So, in most cases, it's usually all the other parts in the valvetrain—or even in the engine block itself—that can get affect cam phasing. In fact, there are at least five things that can still throw an otherwise accurately-ground cam "out of phase:"

Source

Comp Cams; Memphis, TN; 800.999.0853 or 901.795.2400; compcams.com

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1. Improper timing set installation
2. Timing set has "built-in" advance or retard
3. Crank keyway not in proper location
4. Crank rod journals not properly indexed relative to the keyway.
5. Cylinder-block core-shift resulting in lifter bore and/or cam-journal misalignment.

What can happen by not degreeing a cam?

Bearing these possibilities in mind, as I see it, there are three potential negatives for not taking the time to degree a cam:

1. Loss of performance: There are countless cam profiles for any given engine, often with subtle—yet significant—differences. Degreeing a cam ensures it performs up to its performance potential.

2. Piston-to-valve interference: Leading camshaft companies such as Comp Cams can now predict piston-to-valve clearance problems in advance, but all bets are off if the cam phasing is incorrect.

3. Unrecognized assembly error: We all make mistakes. Degreeing a cam will catch these errors, which helps to prevent avoidable parts failures.

Let's take a more granular look at these negatives. To put some numbers on this, let's use a moderate performance engine as an example, say one that's in the 400 lb-ft/400 hp area. That's pretty mild these days, but it can still make a difference!

What is the potential performance loss from not degreeing a cam?

According to Comp Cams Valvetrain Engineering Group Manager Billy Godbold, "If your cam phasing is off 4 degrees, the loss of performance is going to be in the neighborhood of 10 lb-ft on a 400 lb-ft/400 hp application, but only on the ends of the torque curve. This is a big deal in racing, but probably not dramatically bad on the street."

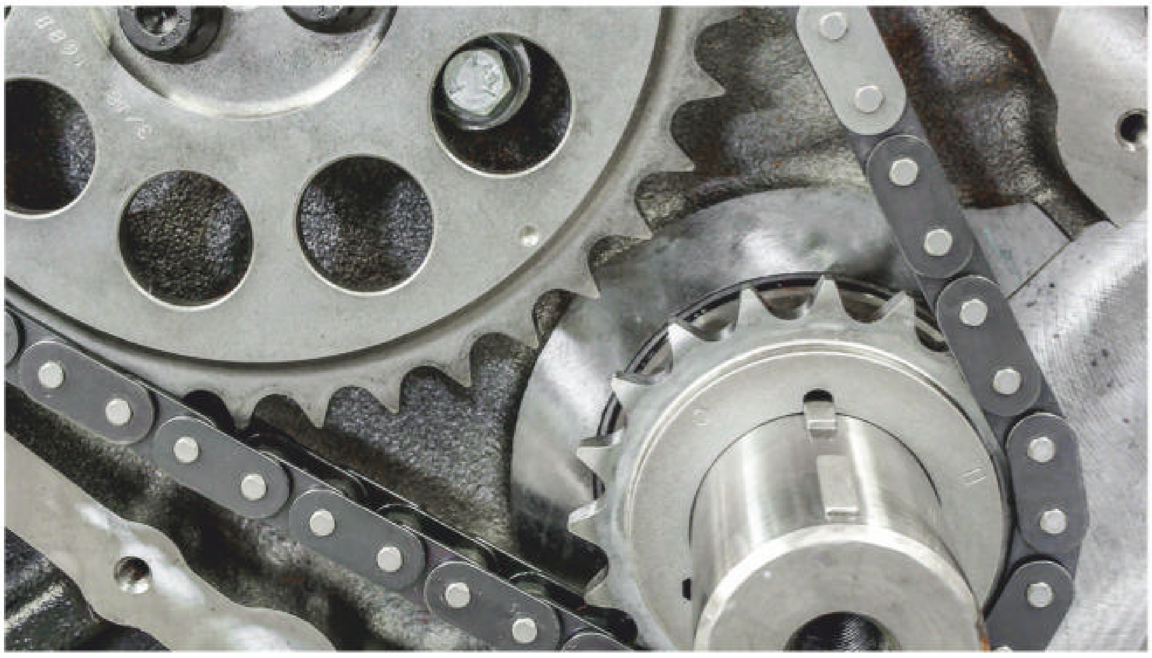
How badly does not degreeing a cam affect piston-to-valve clearance?

What can happen if you don't routinely check camshaft phasing in a custom engine build.

Godbold continues, "That same 4 degrees could reduce piston-to-valve clearance by 0.030 inch. If you were already on the tight side, this is where checking the camshaft intake centerline can save you."

How does degreeing a cam help prevent assembly error?

In aircraft maintenance, there's no pulling over onto the shoulder at 30,000 feet. Critical maintenance tasks are usually double-checked by a second pair of eyes. Usually in the hot rod world, only one guy puts the engine together. Degreeing a cam serves as a "second check" for assembly errors, even in a stock replacement scenario. "If you assemble enough engines, eventually you will get one with the cam timing set a tooth off," Godbold says.



Jeff Smith

Messing up the alignment on multikey crank sprockets is yet another potential "gotcha," which could result in the cam ending up way off. At the least your engine won't respond to "normal" base timing. At worst, the pistons will crash into the valves. By degreeing a cam, you will always catch mistakes like these.

Does the engine model affect the need for degreeing a cam?

Older engines have more individual parts variations; modern engines are often close to blueprint right off the assembly line. So yes, it does make a difference. "On an older engine with a lot of performance parts, tight piston-to-valve clearance, and more individual parts variation, [degreeing a cam] is a 9-plus on the necessity scale," Godbold explains. "But if you are throwing a small 'NSR' (no springs required) Comp Thumpr camshaft in a 5.3L truck LS-series small-block over the weekend and are very careful to get everything lined up, that number could be as low as a 2 or 3."

How "big" does it really need to be before degreeing a cam really makes a difference?

In a practical sense, size does matter. "Anything over 230 degrees duration at 0.050-inch tappet-lift on the intake side should probably be degree'd unless you know something about the piston valve reliefs," maintains Godbold. "Anything under 220 degrees at 0.050 is probably safe. In between is a coin flip." But not degreeing a cam still won't fail-safe an assembly error.

Engine Assembler—or Engine Builder?

As you climb up the food chain of engines, the consequences of cutting corners increase. Have you ever wondered why some guys' engines always seem to pull a little harder coming out of the corners, or e.t. just a shade quicker? It's because these little things—not cutting corners, meticulous assembly, patience—start to add up. A few horses here, a few lb-ft there, and suddenly one engine gains a significant advantage. "At Comp," adds Godbold, "we always degree our camshafts, because often the changes we are looking for are within that 10 lb-ft range. If the last 5–10 lb-ft is important to you, then degreeing a cam is probably a 9 on the 1–10 scale.

"With all the components that can contribute to the centerline moving a degree or two, it is a great habit for anyone to add to their engine building process. It really depends on the accuracy of every component, the overall clearance available, and the importance of maximizing performance." In other words, be an engine builder, not an engine assembler.

Comp Cams

Comp Cams and other high-perf cam companies offers complete cam degree kits. These parts are also available separately if you already have some of the equivalent parts. This kit (PN 4936) is for "heads-off" cam phasing on most Ford, Buick, and Pontiac V8s.

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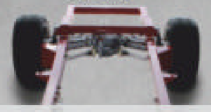

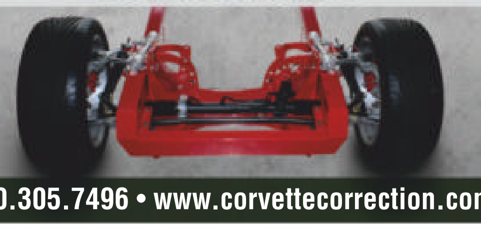

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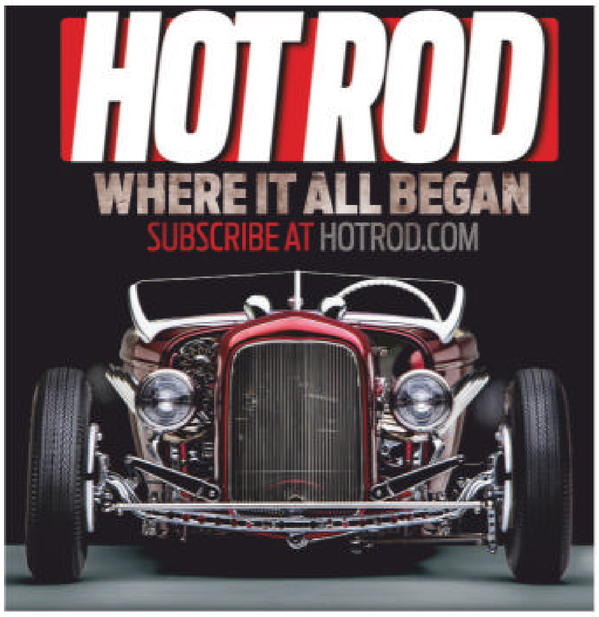

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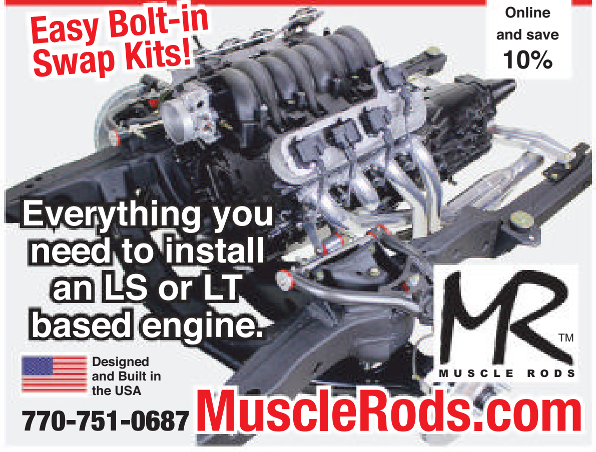

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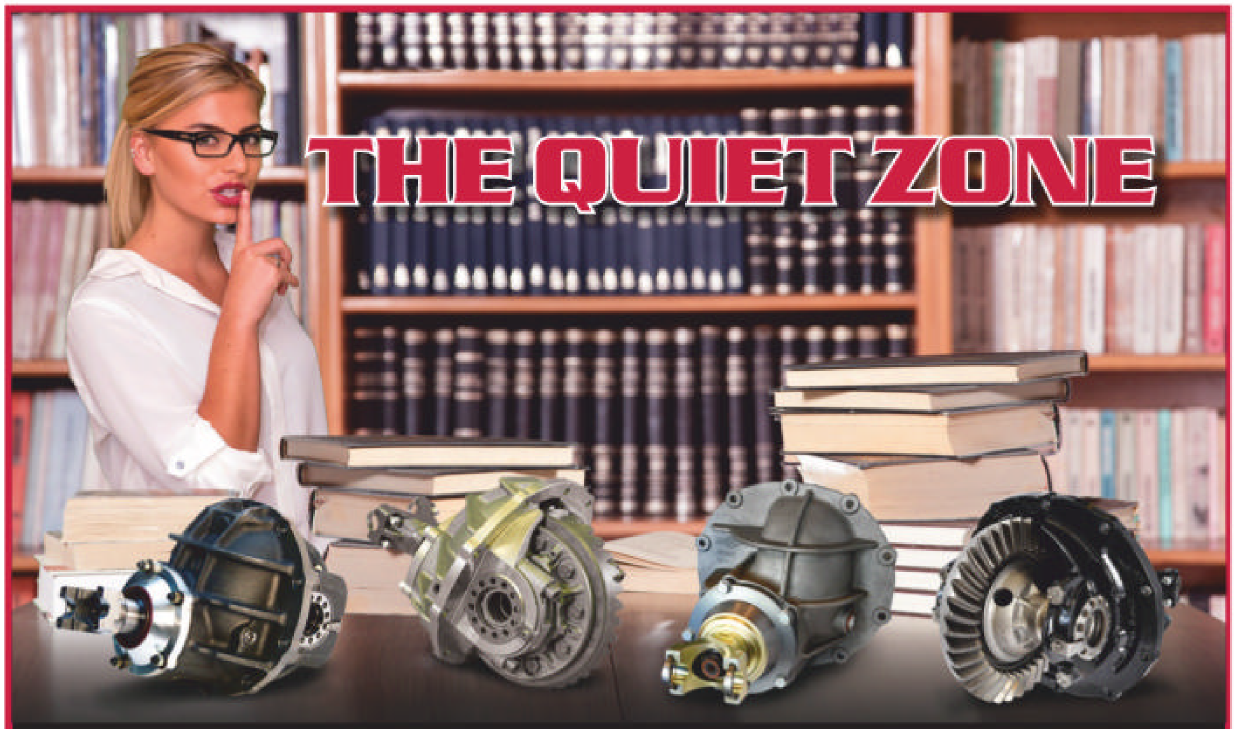

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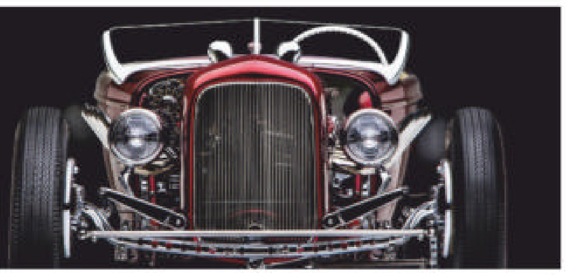

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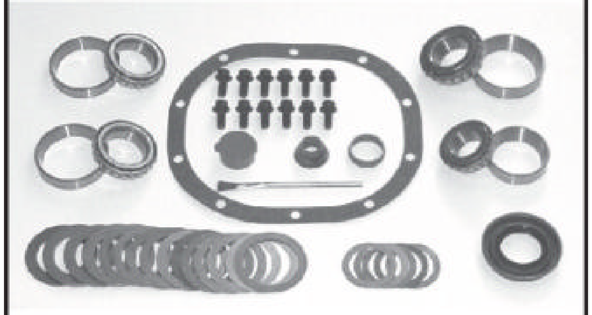

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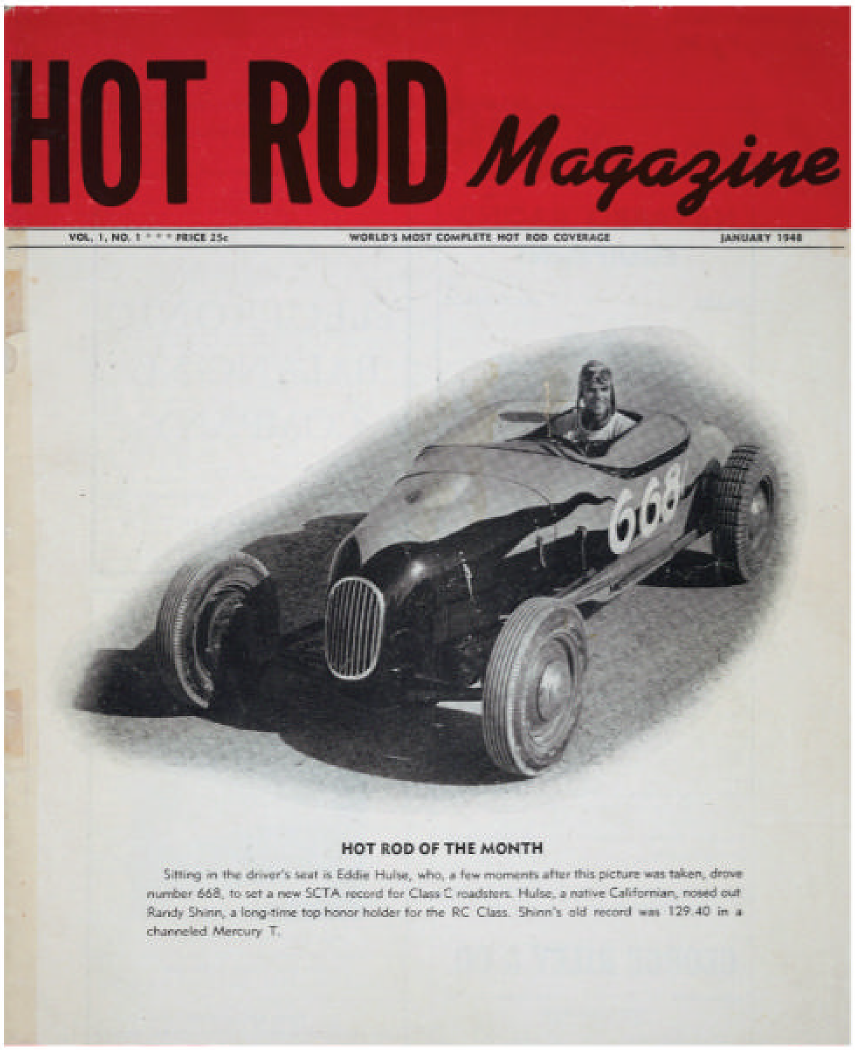


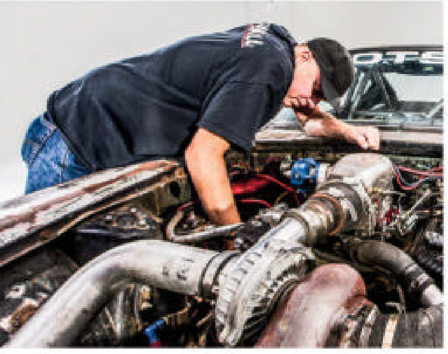
HOT ROD *Magazine*

VOL. 1, NO. 1 * * * PRICE 25c — WORLD'S MOST COMPLETE HOT ROD COVERAGE — JANUARY 1948

HOT ROD OF THE MONTH

Sitting in the driver's seat is Eddie Hulse, who, a few moments after this picture was taken, drove number 668, to set a new SCTA record for Class C roadsters. Hulse, a native Californian, nosed out Randy Shinn, a long-time top honor holder for the RC Class. Shinn's old record was 129.40 in a channeled Mercury T.

Petersen's first issue of HOT ROD in January '48 was sold on the steps of the Los Angeles Armory during the first Hot Rod Exposition indoor car show hosted by the Southern California Timing Association.



THE ORIGINAL INFLUENCER

By David Freiburger

Roadkill
@davidfreiburger

I've been very fortunate to have had a professional connection to HOT ROD for 29 years, and in that time, it's been amazing to hear how HOT ROD has affected people's passions and often their livelihoods. I've most often heard these stories from the pioneers of our hobby as they reflect on the golden years of the '50s and '60s, but also from today's rock stars, from leaders of the OE car manufacturers, and of course from regular hot rodders like you and me.

I don't think that kind of influence was on Robert E. Petersen's mind when he published the first issue in January '48. He just wanted to make a buck—and man, did he. Imagine one magazine holding all the power of today's Internet and then you might grasp what Petersen started for the world of hot rodders. He quickly understood it, and the enthusiasts, and how to serve them. He spurred the rapid growth of the entire automotive performance industry.

By mid '49, Petersen launched *MotorTrend* as a way to collect ad dollars from car manufacturers that didn't want to associate with the readers of HOT ROD, who were still seen as outlaw punks by the mainstream. Petersen had also created a market for his own competitors, and to act as a blockade against *Rod & Custom* mag that was being launched by Quinn Publishing, Petersen released *Honk!* magazine, with both titles having their first issue in May '53. *Honk!* was quickly renamed *Car Craft*. In early 1955, Petersen bought *Rod & Custom* and *Motor Life* from Quinn.

Now, a scheme was in place. *Rod & Custom* would be targeted at pubescent boys, and hence included cool cars, go-karts, and scale model building. Next, the driving-age teens were served by basic tech and cars in *Car Craft*. And then the top step was the authority of HOT ROD, covering nearly every segment of the performance marketplace.

I fell for this strategy, and as a 15-year old considered myself a staunch *Car Craft* guy, deeply affected by the likes of then editor Jeff Smith, but I also subscribed to non-Petersen mags like *Popular Hot Rodding* and *Muscle Car Review*. And, of course, I had HOT ROD because you had to. Everyone did. Though I had little interest in anything but muscle cars and drag racing, I still read every word of articles about Pro Street, street rods, corner carvers, advanced tech I didn't quite understand, and even new cars like the front-drive Dodges that HOT ROD was covering back then. Unwittingly, I was under HOT ROD's influence more than I could have ever recognized at the time. Like myriad others since 1948, it established a path I'd follow for my entire life.

During my roughly 12-year stint leading HRM, I tried to wield the position in accordance with how the founders before me had laid it out, understanding that the strength was in Petersen's vision and that the power was in the brand of HOT ROD that had been the instigator and number-one bugle of the hobby for decades. The responsibility for sustaining the legacy of this great American brand has fallen upon every editor and staffer since 1948, and today, to every cog in the production of modern media, from HOTROD.com producers to social-media posters.

And in the end, the most important question is this: How did HOT ROD affect you?

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